PANASONIC KX-F155

MODEL

SERVICE MANUAL

ORDER NO. KM49206160S1
F7

Service Manual
and Technical Guide

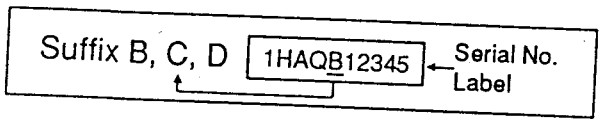
Supplement-4

TELEPHONE ANSWERING
SYSTEM WITH FACSIMILE

KX-F155

Please use this manual together with the service manual for model No. KX-F155, order No. KM4901456A1.

CHANGES



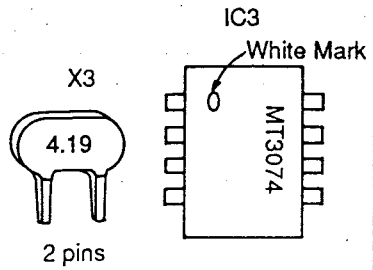
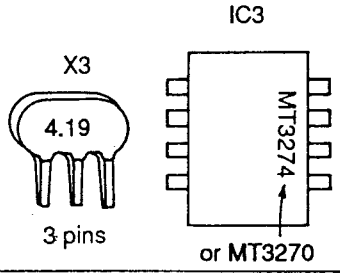
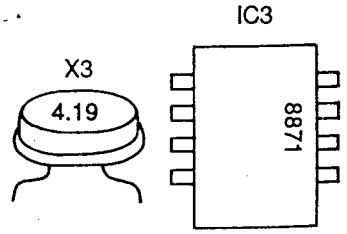
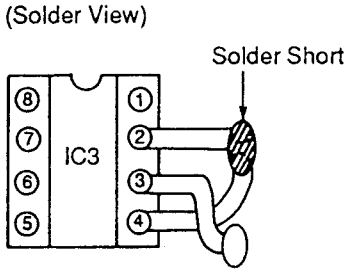
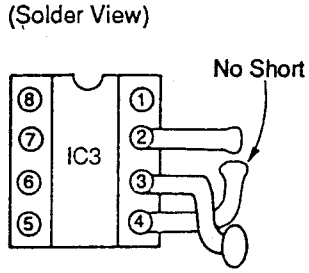
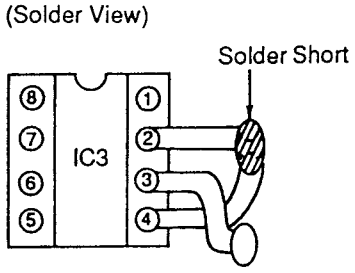
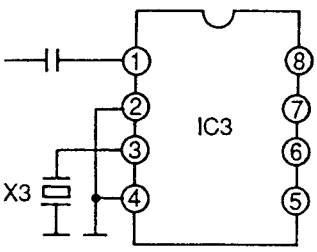
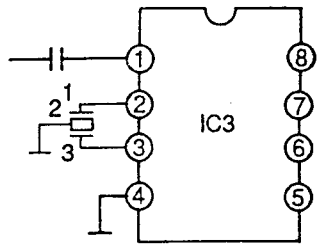
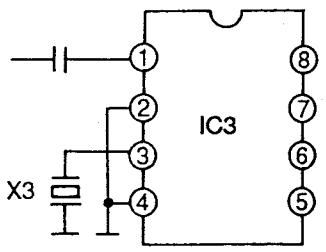
Subject:

No.	Suffix	Reason for suffix change
1	A→B	Change of the ROM version
2	B→C	Change of the ROM version
3	C→D	Remove of JAM sensor

Panasonic

Note:
Three types of parts are used as IC3 (DTMF Receiver IC) and X3 (Ceramic Filter/Crystal Oscillator) in Analog Board.
Please replace them according to Parts Comparison Table.

■ PARTS COMPARISON TABLE

Ref. No.	Original (Part No.)	**Change-1 (Part No.)**	**Change-2 (Part No.)**
IC3	PQVIM3074AE1	**PQVIMT3274AE**	**PQVIXRU8871**
X3	PQVBA4.19M2	**PQVBT4.19G2**	**PQVCL4194N9Z**
Figure			
P.C. BOARD			
SCHEMATIC DIAGRAM			

I Ⓕ M, C
Printed in Japan

ORDER NO. KM49101463S1
F7

Service Manual
and Technical Guide

Supplement-1

TELEPHONE ANSWERING
SYSTEM WITH FACSIMILE

KX-F155

Please use this manual together with the service manual for model No. KX-F155, order No. KM49101456A1.

CHANGES

■ REPLACEMENT PARTS LIST

Reason for Change *The circled item indicates the reason. If no marking, see the Notes in the bottom column.

1. Improve performance	
2. Change of material or dimension	
3. To meet approved specification	
4. Standardization	
5. Addition	
6. Deletion	
7. Correction	
8. Other	

Interchangeability Code **The circled item indicates the interchangeability. If no marking, see the Notes in the bottom column.

	Parts		Set Production	
A	Original New	⤫	Early Late	Original or new parts may be used in early or late production set. Use original parts until exhausted, then stock new parts.
B	Original New	↗	Early Late	Original parts may be used in early production sets only. New parts may be used in early or late production sets. Use original parts where possible, then stock new parts.
C	Original New	↗	Early Late	New parts only may be used in early or late production sets. Stock new parts.
D	Original New	→	Early Late	Original parts may be used in early production sets only. New parts may be used in late production sets only. Stock both original and new parts.
E	Other			

Part Number

Ref. No.	Original Part No.	New Part No.	Parts Name & Description	Pcs/Set	Remarks	Notes
Cabinet, Mechanical and Electrical Parts						
25	PQJHS9Z	**PQJHS9Z or PQJHS8Z**	Thermal Head	1		4 A
27	PQJS19S30Y	**PQJS19S30X**	Connector, 19P	1		8 A
48	PQHR5289Z	**PQHR5289Y**	Peading Plate	1		8 A
60	PQKM195X8 or W8	**PQKM195U8**	Cabinet Body, Handset Cradle	1		8 B
101	PQHR9418Z	**PQHR9418Y**	Lock Lever, Right	1		8 A
107	PQHR9425Z	**PQHR9425Y**	Spacer, Separation Roller	2		8 A
121	PQZSF50M	**PQUS227X**	Spring, Sub Roller-B M'tg	1		8 A
124	PQJM120Z	**PQJM124Z**	Microphone	1		8 D
Cassette Deck Parts						
M17	PQUP589Z	**PQUP589Y**	P.C.Board, Reed Switch	1		8 A
Accessories and Packing Materials						
A1	PQJA59Y	**PQJA59V**	Cord, TEL.	1		8 A

Panasonic

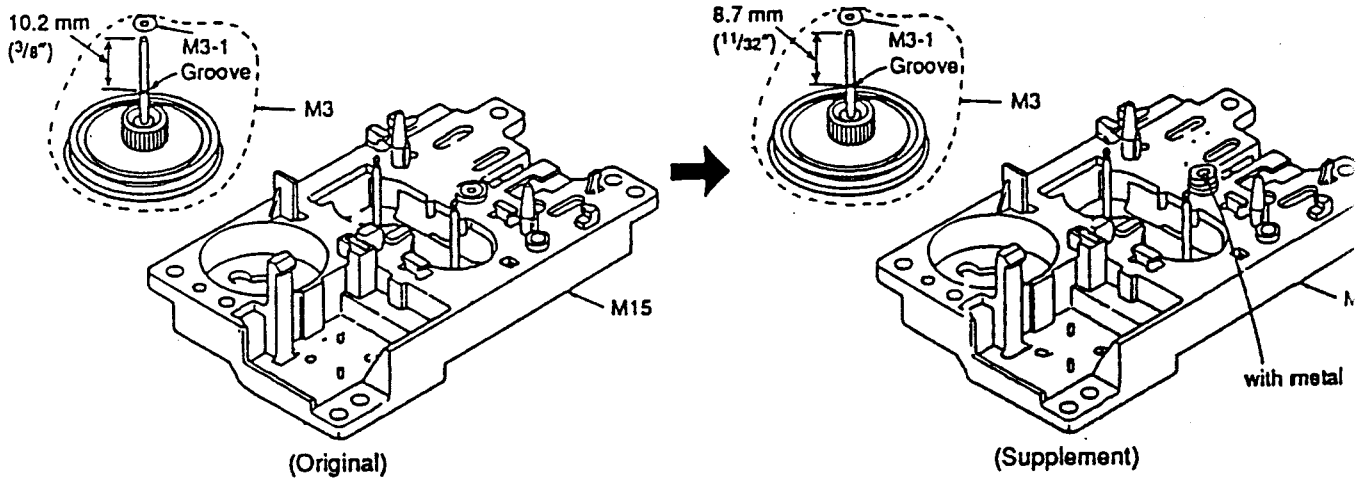
■ PARTS COMPARISON TABLE

Reason for Change	*The circled item indicates the reason. If no marking, see the Notes in the bottom column.
1. Improve perfomance	
2. Change of material or dimension	
3. To meet approved specification	
4. Standardization	
5. Addition	
6. Deletion	
7. Correction	
8. Other	

Interchangeability Code	**The circled item indicates the interchangeability. If no marking, see the Notes in the bottom column.	
	Parts / Set Production	
A	Original / New → Early / Late	Original or new parts may be used in early or late production set. Use original parts until exhausted, then stock new parts.
B	Original → Early / New → Late	Original parts may be used in early production sets only. New parts may be used in early or production sets. Use original parts where possible, then stock new parts
C	Original / New → Early / Late	New parts only may be used in early or late production sets. Stock new parts.
D	Original → Early / New → Late	Original parts may be used in early production sets only. New parts may be used in late production sets only. Stock both original and new parts.
E	Other	

Ref. No.	Part No.		Part Name & Description	Pcs/ Set	Note 1	Note 2
	Original Part No.	New Part No.				
M3	PQFF9909Z	PQFF9909Y	Flywheel Assembly	1		1D
M15	PQFC9909X	PQFC9909W	Chassis Mechanism Assembly	1		1D

Note: Parts of M3 and M15 have been chenged at the same time.



(Original) (Supplement)

Ref. No.	Original Part No.	New Part No.	Part Name & Description	Pcs/Set	Remarks	Notes	Time of Change (Suffix)
Operation and Sensor Board Parts							
R801	ERDS2TJ331	----------	Resistor, 330Ω	0	*4	6	D
S101-107, 120-127 ,130-142	EVQ12405K	**EVQ22405K**	Switch	28		8 A	
PC801	PQVIPS6002	----------	Sensor, JAM	0	*4	6	D
CCD Board Parts							
C107	PQCUV1E104MD	**ECUV1H104MD**	Capacitor, 0.1µF	1		8 D	
Switching Power Supply Board Parts							
PCB5	PQLP017Z	**PQLP025Z**	Switching Power Supply Board Ass'y (NLA)	1	*2	8 A	
D415	MA7062	**MA4062**	Diode (SI)	1	*2	8 D	
F403	PQBA1P15NMAL	----------	Fuse	0	*2	6	
C440	ECKZRS102ME	**ECKDRS332ME**	Capacitor, 0.0033µF	1		1 B	
C451	EC0S2DG561M	**EC0S2DG561L**	Capacitor, 560µF	1		7	
C491, 492	----------	**ECKD3A221KBN**	Capacitor, 220PF	2	*2	5	
R440	ERX3SJ5R6	----------	Resistor, 5.6Ω	0		6	
R482	----------	**ERDS2TJ101**	Resistor, 100Ω	1	*2	5	

Notes:

1. Part with mark *1 has been changed at the same time.
2. Part with mark *2 has been changed at the same time.
3. Part with mark *3 has been changed at the same time.
4. Part with mark *4 has been changed at the same time.

■ REPLACEMENT PARTS LIST

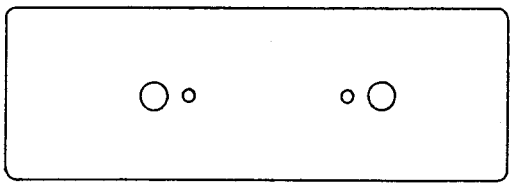
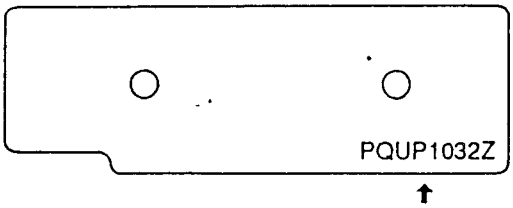
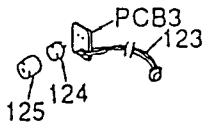
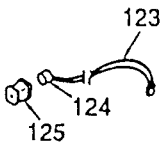
Reason for Change	*The circled item indicates the reason. If no marking, see the Notes in the bottom column.
1. Improve performance	
2. Change of material or dimension	
3. To meet approved specification	
4. Standardization	
5. Addition	
6. Deletion	
7. Correction	
8. Change of design	

Interchangeability Code	**The circled item indicates the interchangeability. If no marking, see the Notes in the bottom column.	
	Parts / Production Set	
A	Original → New / Early → Late	Original or new parts may be used in early or late production set. Use original parts until exhausted, then stock new parts.
B	Original → New / Early → Late	Original parts may be used in early production set only. New parts may be used in early or late production set. Use original parts where possible, then stock new parts.
C	Original → New / Early → Late	New parts only may be used in early or late production set. Stock new parts.
D	Original → New / Early → Late	Original parts may be used in early production set only. New parts may be used in late production set only. Stock both original and new parts.
E	Other	

Part Number

Ref. No.	Original Part No.	New Part No.	Part Name & Description	Pcs/Set	Remarks	Notes	Time of Change (Suffix)
Cabinet, Mechanical and Electrical Parts							
9	PQBCX171Z1	**PQBCX171Z2**	Button, OGM PLAY/REC/ICM ERASE	1		8 A	
21	PQHR9423Z	**PQHR9614Z**	Cover, Operation Grille	1		8 A	
26	PQHE5020Y	**PQHE5020X**	Screw, Thermal Head M'tg	2		8 A	
28	PQGP119Z	**PQGP119Y**	LED Cover	3		8 B	
53	PQMD9021Z	**PQMD9021Y**	Gear Chassis-A	1		8 A	
60	PQKM195W or PQKM195V	**PQKM195U**	Cabinet Body, Handset Cradle	1		8 A	
78	PQDF9029Z	**PQDF9029Y**	Shaft, Sub Roller	2		8 A	
86	PQHR9429Z	----------	Lever, CCD Adjustment	0		6	
89	PQUS208Z	**PQHM140Z**	Bracket, Lock Lever	2		8 A	
94	PQMD9014Z	**PQMD9014Y**	Gear Chassis-B	1		8 A	
98	PQMD9013Z	**PQMD9013Y**	Gear Chassis-C	1		8 A	
110	PQDF9042Z	**PQDF9042Y**	Shaft, Sub Roller-B	1		8 A	
111	PQUS209Z	**PQUS209X**	Spring, Sub Roller-A M'tg	2		8 A	
112	PQHR9539Z	**PQHR9539Y**	Lever, Sensor	1		8 A	
118	PQHR9416Y	**PQHR9416X**	Lever, Recording Paper Det.	1		8 A	
123	PQJS2L96Z	**PQJS2L99Z**	Connector, 2P	1		8 A	
124	PQJM124Z	**PQJM128Z**	Microphone	1	*1	8 D	
125	PQHG503Z	**PQHG556Z**	Rubber Parts, MIC Cover	1	*1	8 D	
127	PQHR9451Z	**PQHR9451Y**	Spacer, Hook Switch	1		8 A	
200	PQHR9410Z1	----------	Slider-L	0		6	
201	PQHR9411Z1	----------	Slider-R	0		6	
202	PQHR9412Y1	----------	Cover, Slider	0		6	
203	PQKE71Y1	**PQYEF2090XSA**	Document Tray Ass'y	1		8 B	
204	PQKE72Y	----------	Tray (Small)	0		6	
205	PQDG5042Z	----------	Gear	0		6	
Accessories and Packing Materials							
A11	XZB25X34A04	**PQPP10005Z**	Protection Cover (Document)	1		8 A	
A13	PQPH103Z	**PQPP10006Z**	Protection Cover (Tray)	1		8 A	
Digital Board Parts							
C208	PQCUV1E104MD	----------	Capacitor, 0.1µF	0	*4	6	D
Analog Board Parts							
IC3	PQVIM3074AE1	**PQVIMT3274AE**	IC	1	*3	8 D	
IC6, 7	PQVITM41256A or PQVIHD89711P	**PQVIV0ICE111**	IC	2		8 A	
IC11	AN6181K	**AN6181NK**	IC	1		8 B	
X3	PQVBA4.19M2	**PQVBT4.19G2**	Ceramic Filter	1	*3	8 D	
R164, 165	ER016CKF21281	**ER016KF21281**	Resistor, 21.28KΩ	2		7	
R166	ER016CKF10641	**ER016KF10641**	Resistor, 10.64KΩ	1		7	

■ PARTS COMPARISON TABLE

Ref. No.	Original Part	New Part
PCB4, IC102 (CCD Board)		
124 (MIC) 125 (MIC Cover)		

ORDER NO. KM49211386S1

Service Manual

Supplement-1~7

and Technical Guide

TELEPHONE ANSWERING SYSTEM WITH FACSIMILE

KX-F50, KX-F90, KX-F110
(for Canada)

PAX200H, PAX400H, PAX600H
KX-F50, KX-F60, KX-F90, KX-F110
KX-F155, KX-F195, KX-F215, KX-F5000
(for U.S.A.)

Please use this manual together with the original Service Manuals for the below models.

CHANGES

Subject: Change of DTMF Receiver (IC)

Model No.	Country	Order No.	Supplement No.
KX-F50	U.S.A.	KM49010294C1	5
KX-F50	Canada	KM49010305A1	5
KX-F60	U.S.A.	KM49106655A1	3
KX-F90	U.S.A.	KM49009277C1	7
KX-F90	Canada	KM49012435A1	7
KX-F110	U.S.A.	KM49101457C1	6
KX-F110	Canada	KM49103547A1	5
KX-F155	U.S.A.	KM49101456A1	5
KX-F195	U.S.A.	KM49010295A1	7
KX-F215	U.S.A.	KM49107740A1	4
KX-F5000	U.S.A.	KM49203990C1	1
PAX200H	U.S.A.	KM49101458A1	3
PAX400H	U.S.A.	KM49102486A1	5
PAX600H	U.S.A.	KM49105612A1	5

Panasonic

ORDER NO. KM49101456A1
F7

Service Manual

TELEPHONE ANSWERING SYSTEM WITH FACSIMILE

and Technical Guide

KX-F155

REVISION

Please use this manual together with the service manual for model No. KX-F50, order No. KM49010294C1.
This Service Manual indicates the main differences between; Original KX-F50 and KX-F155.

■ PARTS COMPARISON TABLE

Ref. No.	Part No.		Part Name & Description	Pcs/ Set	Remarks
	KX-F50 (Original)	KX-F155			
Cabinet, Mechanical and Electrical Parts					
1	PQGP125Z	**PQGP125Y1**	Panel	1	
3	PQHP5056Z	**PQHP5056Y1**	Card, Memory	1	
5	PQKG10Y	**PQKG10W1**	Cassette Lid	1	
7	PQGG87Y	**PQGG87X1**	Grille, Operation	1	
9	PQBCX171Z	**PQBCX171Z1**	Button, OGM PLAY/REC/ICM ERASE	1	
10	PQBCX170Z	**PQBCX170Z1**	Button, REW/FF/MEMO/2WAY	1	
11	PQBC260Z	**PQBC260Z1**	Button, PLAYBACK/PAUSE	1	
12	PQBCX172Z	**PQBCX172Z1**	Button, FLASH, REDIAL	1	
13	PQBC261Z	**PQBC261Z1**	Button, MONITOR/VOICE STDBY	1	
14	PQBCX167Z	**PQBCX167Z1**	Button, DIAL/PRO/SET/PAUSE/AUTO	1	
15	PQBC259Z	**PQBC259Z1**	Button, STOP/CLEAR	1	
16	PQBCX169Y	**PQBCX169Y1**	Button, FINE/LIGHT/POLLING/RECE.	1	
17	PQBCX168Z	**PQBCX168Z1**	Button, MEMORY	2	
49	PQZMF50M	**PQZMF155M**	Document Guide-A Ass'y	1	
50	PQUV104Y	**PQUV104Y8**	Rear Cover	1	
60	PQKM195Y	**PQKM195X8** or **PQKM195W8**	Cabinet Body, Handset Cradle	1	
61	PQBE32Z	**PQBE32Z1** or **PQBE32Y1**	Button, Hook	1	
64	PQYMF50M	**PQYMF155M**	Upper Cabinet Ass'y	1	
66	PQBD163Z	**PQBD163Z1**	Knob, FRONT/BACK LID OPEN	1	
67	PQJX2PA4409Z	**PQJX2PAA409Z**	Handset Ass'y	1	
75	PQYEF50M	**PQYEF155M**	Document Lid	1	
77	PQHR9428Z	**PQHR9428Z8**	Document Guide, Upper Side	1	
80	PQHR9445Y	**PQHR9445Y1**	Document Guide-B	1	
113	PQHR9489Z	**PQHR9489Z1**	Upper Guide, Recording Paper	1	
114	PQHR9490Z	**PQHR9490Z1**	Lower Guide, Recording Paper	1	
115	PQYFF50M	**PQYFF155M**	Lower Cabinet	1	
116	PQKE55Z1	**PQKE55Z2**	ROM Lid	1	
117	PQBD162Z	**PQBD162Z1**	Knob, Volume	1	
200	PQHR9410Z	**PQHR9410Z1**	Slider-L	1	
201	PQHR9411Z	**PQHR9411Z1**	Slider-R	1	
202	PQHR9412Y	**PQHR9412Y1**	Cover, Slider	1	
203	PQKE71Y	**PQKE71Y1**	Tray (Large)	1	
Accessories and Packing Materials					
A2	PQJA200Z	**PQJA200Y**	Cord, Power	1	⚠
A3	PQJA30V	**PQJA30M** or **PQJA212M**	Cord, Handset	1	
A6	PQQX6246Z	**PQQX6317Z**	Instruction Book	1	
P1	PQPK1189Z	**PQPK1239Z**	Gift Box	1	

Note:
Electrical parts of KX-F155 are the same as those of KX-F50 and are omitted from the above list.

Panasonic

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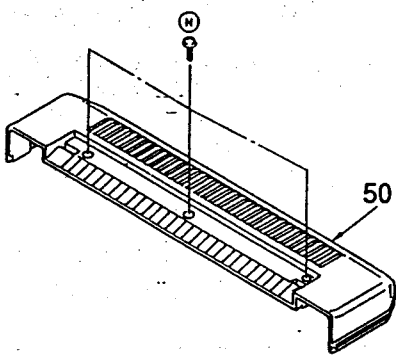
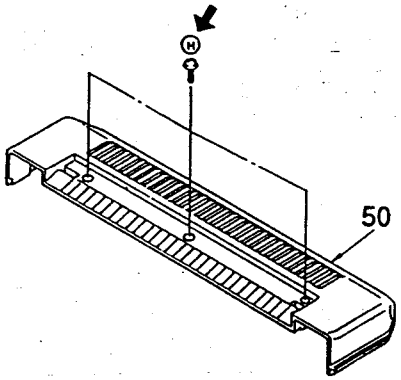
Carolina, Puerto Rico 00630

■ CABINET, MECHANICAL AND ELECTRICAL PARTS LOCATION



(Model KX-F50)

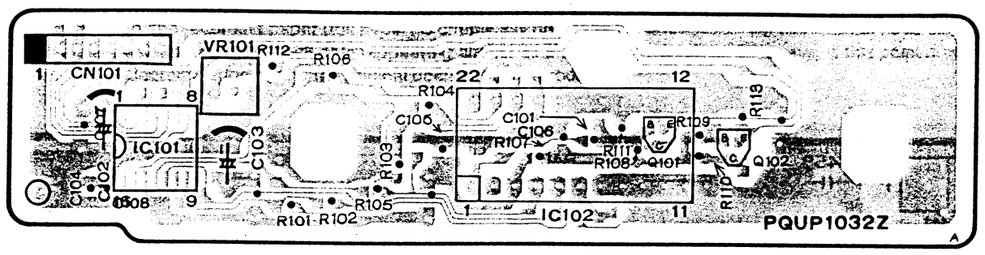


(Model KX-F155)

I Ⓕ KXF155M
Printed in Japan

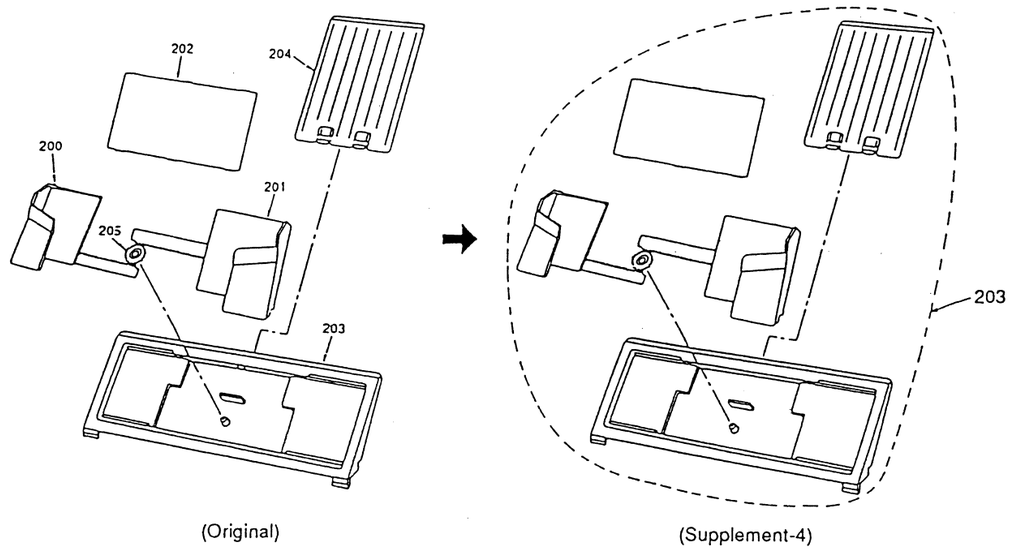
■ PRINTED CIRCUIT BOARD (CCD BOARD)

(COMPONENT VIEW)



(Supplement-4)

■ CABINET, MECHANICAL AND ELECTRICAL PARTS LOCATION

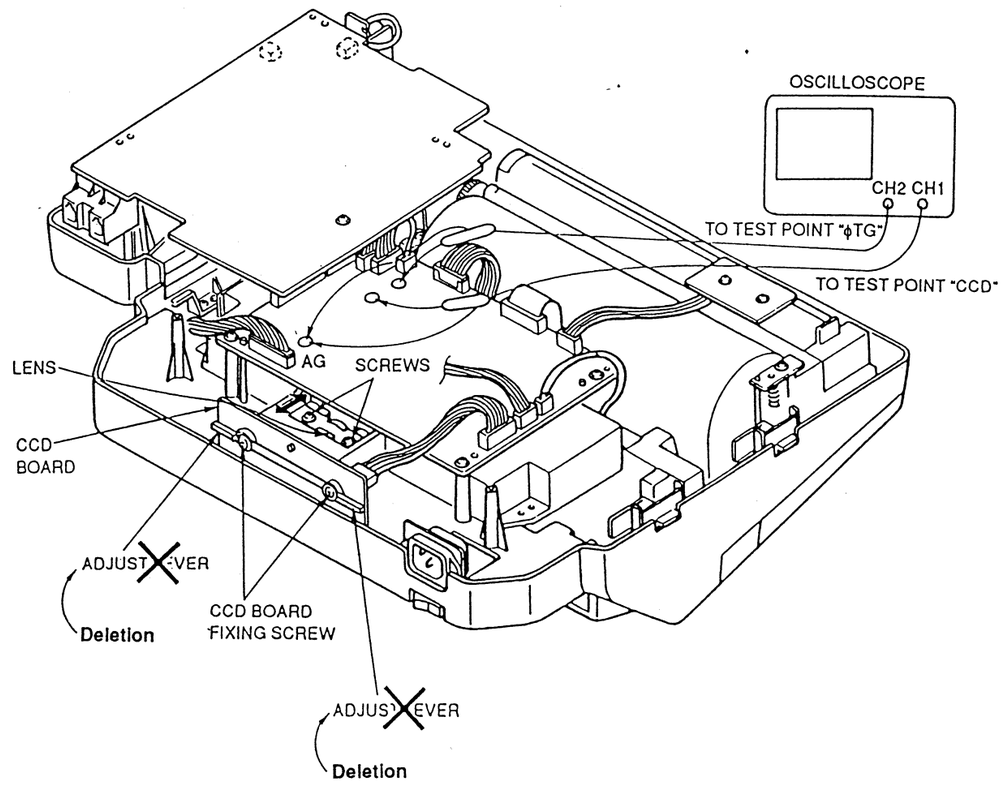


(Original) (Supplement-4)

■ ADJUSTMENTS

LENS AND CCD READ POSITION ADJUSTMENT

1) Loosen the lens fixing screw and CCD board fixing screw.
2) Adjust the position of the lens and CCD board so that the waveform appears as shown in the figure below.
3) Fix the lens fixing screw and CCD board fixing screw.

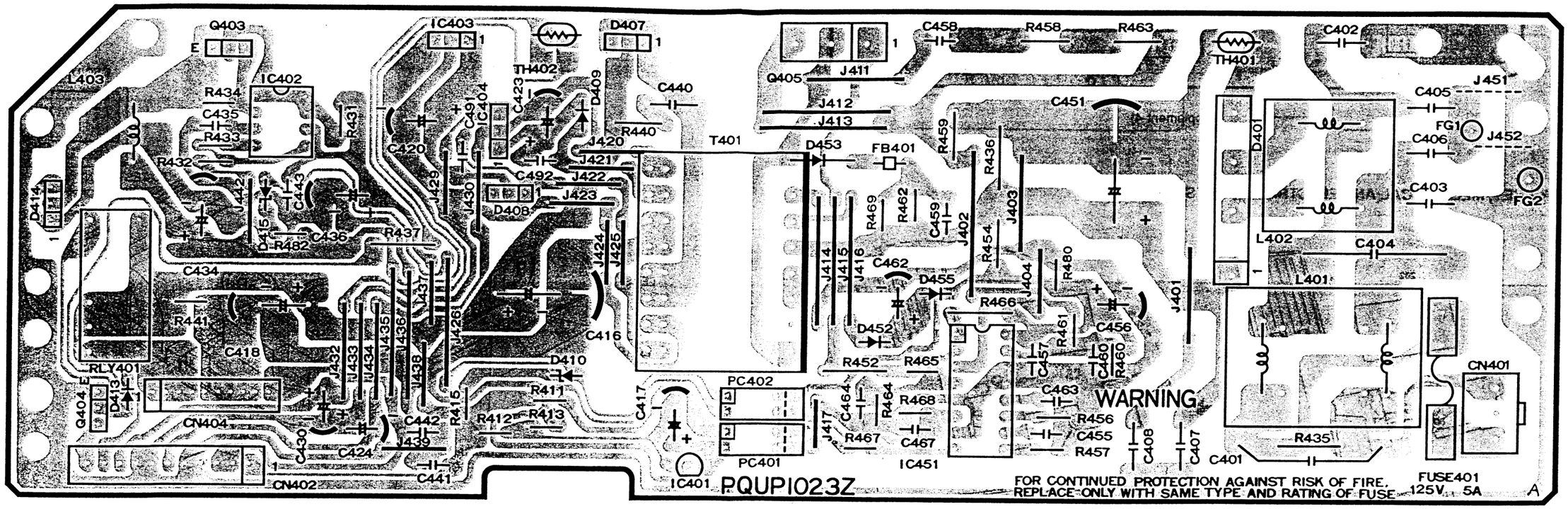


Note:
If the 2-hole type CCD Board (PQUP1032Z) is used, it is not necessary to use the Adjustment Lever.

(Supplement-4)

■ PRINTED CIRCUIT BOARD (SWITCHING POWER SUPPLY)

COMPONENT VIEW



(Supplement-4)

Note:
Latch is being locked within about 1 minute after the power switch is turned off to disable transmitting. Therefore, turn the power switch on when more than 1 minute have elapsed after power off.

ORDER NO. KM49203995S1
F1, F7

Service Manual

and Technical Guide

Supplement

KX-T1000, KX-T1600, KX-T2385D, KX-T2385D-1,
KX-T2388, KX-T2390, KX-T2390-1, KX-T2395,
KX-T2630, KX-T2632, KX-T2634, KX-T2740,
KX-T4200, KX-T4200-1, KX-T4300

KX-F50, KX-F60, KXF80, KX-F90, KX-F100, KX-F110,
KX-F120, KX-F155, KX-F195, KX-F215, KX-F220,
KX-F320, KX-F3500

PAX200H, PAX300H, PAX400H, PAX600H

for U.S.A. for The Shaper Image

• Please use this manual together with the original Service Manuals for the below models.

CHANGES

Subject: Change of Head Base (PQFW42Z → PQFW42Y).

MODEL NO.	ORDER NO.	Supplement No.
KX-T1000	KM48907951C1	4
KX-T1600	KM48803650C1	2
KX-T2385D	KM48806715C1	2
KX-T2385D-1	KM48810754A1	3
KX-T2388	KM49008259C1	3
KX-T2390	KM48901820C1	3
KX-T2390-1	KM48911061C1	3
KX-T2395	KM49009263C1	3
KX-T2630	KM48805687C1	6
KX-T2632	KM48806698C1	8
KX-T2634 (for U.S.A.)	KM48907954C1	3
KX-T2634 (for the shaper image)	KM49004206A1	2
KX-T2740 (for U.S.A.)	KM49003166C1	4
KX-T2740 (for the shaper image)		1
KX-T4200	KM48808736C1	5
KX-T4200-1 (for U.S.A.)	KM49001135A1	3
KX-T4200-1 (for the shaper image)	KM49004204A1	2

MODEL NO.	ORDER NO.	Supplement No.
KX-T4300	KM49106648C1	1
KX-F50	KM49010294C1	3
KX-F60	KM49106655A1	2
KX-F80	KM48907964C1	3
KX-F90	KM49009277C1	5
KX-F100	KM48901819C1	4
KX-F110	KM49101457C1	4
KX-F120	KM48808742C1	4
KX-F155	KM49101456A1	3
KX-F195	KM49010295A1	5
KX-F215	KM49107740A1	1
KX-F220	KM48909031C1	2
KX-F320	KM48912098C1	2
KX-F3500	KM48811771A1	3
PAX200H	KM49101458A1	1
PAX300H	KM49004193C1	4
PAX400H	KM49102486A1	2
PAX600H	KM49105612A1	2

Panasonic

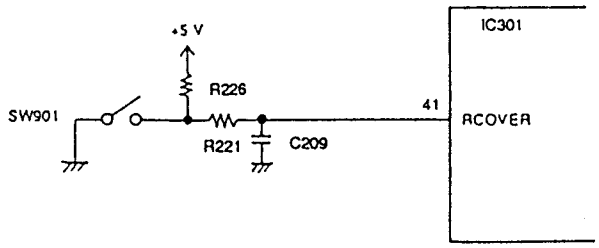
■ CIRCUIT OPERATIONS (Page 83)

2) Sensor

Corrected

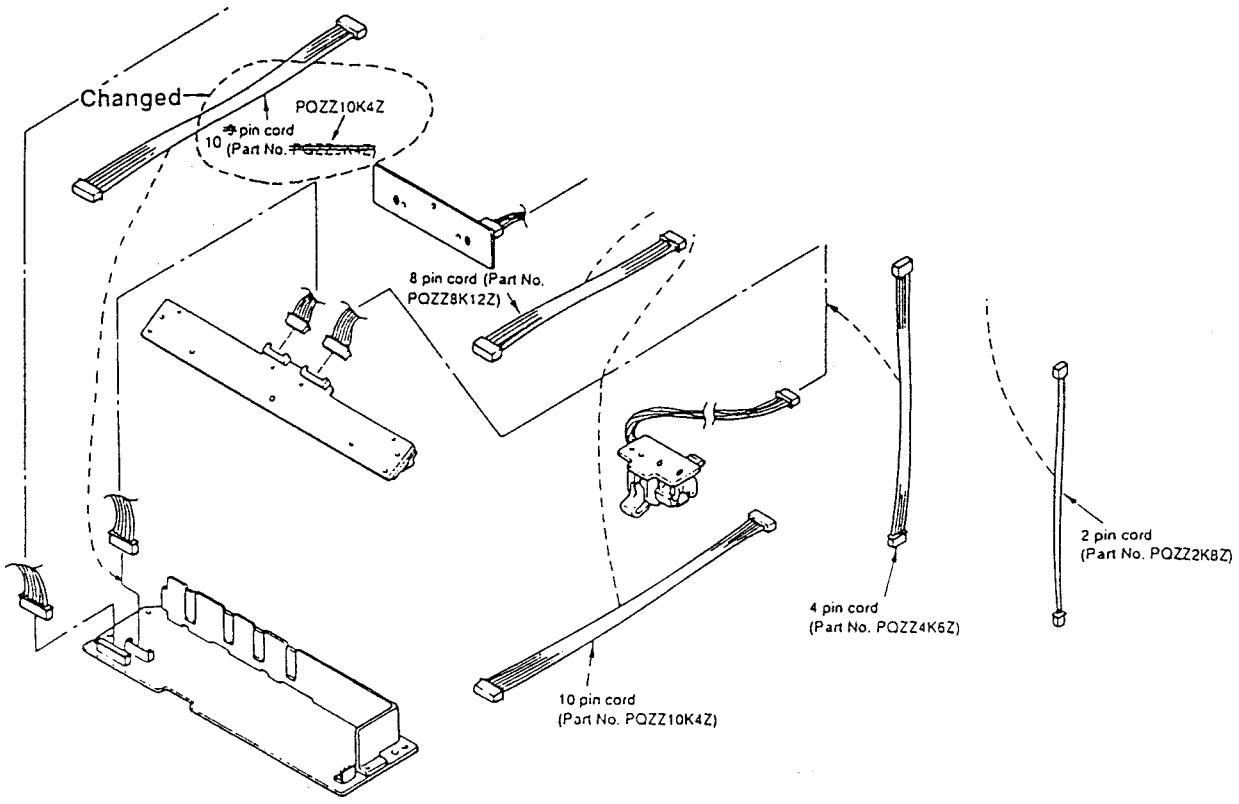
[Cover Open Switch (SW901)]
When the upper cabinet is closed, the lever of SW901 is pushed and the switch becomes OFF.

Circuit Diagram

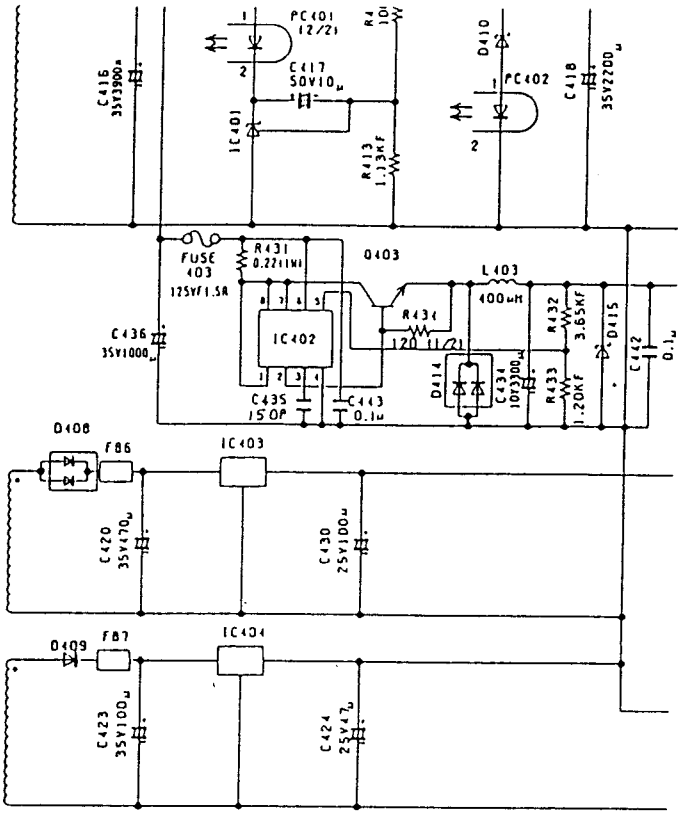


	SW901	Signal (IC301-41 pin)
Open	ON	Low Level
Close	OFF	High Level

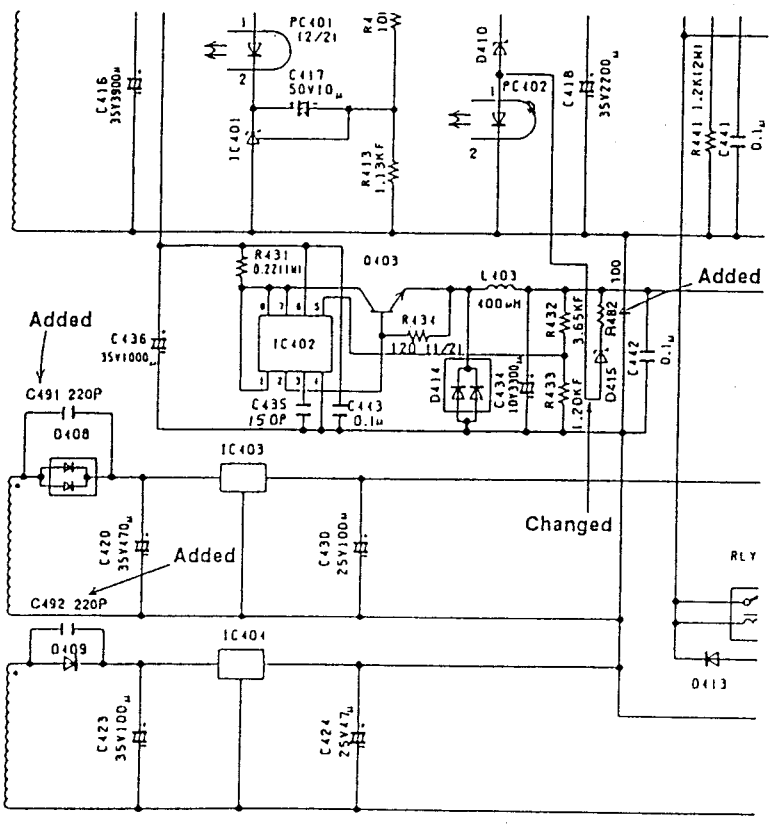
■ CONNECTOR LEAD AND EXTENSION CORD CONNECTING METHOD



■ SCHEMATIC DIAGRAM (SWITCHING POWER SUPPLY)



(Original)



(Supplement-4)

CORRECTIONS

■ TROUBLESHOOTING GUIDE

3. SERVICE FUNCTION TABLE **(Pages 14 and 15)**

50	Memory clear (Refer to page 13.) Returns the set values of #1~~#34~~ (#30~E34: user selectable) to default. **#33**				"START/COPY
60	~~Cutter select~~	1..1 per page ~~2..2 per call~~ 3..Off **Deletion**	1~3	1	
63	CCD position adjustment value set	×1 mm	~~-20~20~~ **0~30**	~~00~~ **15**	Press "*" for e negative value
72	ITS auto redial line disconnection time set	× second	001~999	~~30~~ **030**	
81	ICM Tape End Detection set	1. ~~Off~~ 2. Off **On**	1, 2	2	
83	2-way beep time set	~~×10 ms.~~ **×1 ms.**	~~00~99~~ **000~999**	~~17~~ **170**	
92	CNG transmit select	1..auto/manual 2..auto 3..Off	1~3	~~1~~ **2**	
93	Time between CED and 300 bps	~~×10 ms.~~ **×1 ms.**	~~006~999~~ **0055~3450**	~~008~~ **0075**	
97	Transmit speed fixed mode select	~~1..9600BPS~~ ~~2..7200BPS~~ ~~3..4800BPS~~ ~~4..2400BPS~~ ~~5..Off~~ **1...2400BPS** **2...Off**	~~1~5~~ **1, 2**	~~5~~ **2**	

■ CIRCUIT OPERATIONS

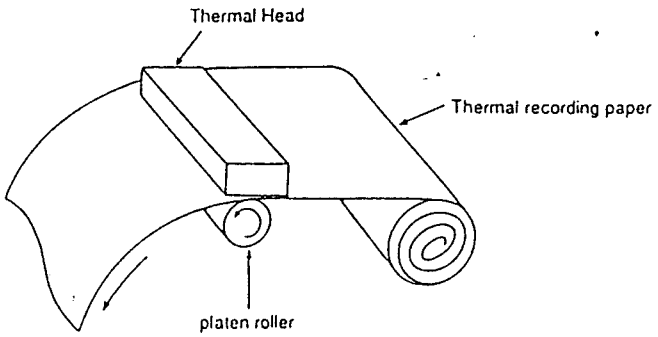
3-2. THERMAL HEAD (Page 75)

1) Function

This unit utilizes state of the thermal printer technology.

In this formation, the recording paper (roll paper) is chemically processed in advance.When the thermal head contacts this paper emits heat momentarily, black dots (appearing almost as a point) are printed on the paper. If this point is continued, letters and/or diagrams appear, and the original document is reproduced.

COMPOSITION OF THE RECEIVE RECORD SECTION (THERMAL RECORDING FORMAT)



2) Circuit Operation

There are 27 driver ICs aligned horizontally on the thermal head and each one of these ICs can drive 64 heat emitting resistors. This means that one line is at a density of 64×27≒1728 dots = (8 dots/mm).

White/Black (white = 0, black = 1) data in one line increments is synchronized at IC2 pin 4 (THCLK) and sent from IC2 pin 3 (THDAT) to the shift resistor of the ICs. The shift resistors of the 27 ICs are connected in series, and upon shift of 1728 dot increment, all the shift resistors become filled with data, and a latch pulse is emitted to each IC from IC2 pin 7 ($\overline{\text{THLAT}}$). With this latch pulse, all the contents of shift resistors are latched to the latch resistors. Thereafter, through the addition of strobe from the IC2 pins (8, 9, 10, 11) only dot of location to black (=1) among latched data activates driver, and current passes to heat emitting body to cause heat emission.

Here the strobe of four lines STB0 to STB3 impresses at intervals of 9.22 msec., as required for one-line printout, for each 1/4th of 27 IC unit (6 unit or 7 unit) upon each time interval divided into four equal increments.

The sequence is as shown below. (Moreover, in the case of strobe width, the resistance value of the thermistor inside the thermal head is constantly detected by the A/D converter (IC9), and values from the ROM (IC4) table corresponding to temperatures eliminate temperature changes of density through setting by CPU part of the CPU/Modem (IC1).

When the thermal head is not used, the gate array IC2 (93, THON) becomes low level, Q404 in the power supply unit becomes OFF, RLY401 breaks, and the +24 V power supply for the thermal head driver is not impressed to protect the IC.

Corrected

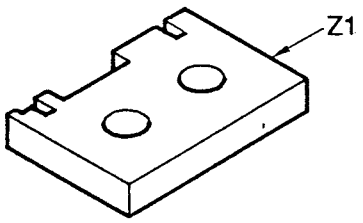
■ PARTS COMPARISON TABLE

Reason for Change	The circled item indicates the reason. If no marking, see the Notes in the bottom Column.
1. Improve performance	
2. Change of material or dimension	
3. To meet approved specification	
4. Standardization	
5. Addition	
6. Deletion	
7. Correction	
8. Other	

Interchangeability Code	"The circled item indicates the interchangeability. If no marking, see the Notes in the bottom column.
Parts / Set Production	
A Original / New → Early / Late	Original or new parts may be used in early or late production set. Use original parts until exhausted, then stock new parts.
B Original / New → Early / Late	Original may be used in early production sets only. New parts may be used in early or production sets. Use original parts where possible, then stock new parts.
C Original / New → Early / Late	New parts only may be used in early or late production sets. Stock new parts.
D Original / New → Early / Late	Original parts may be used in early production sets only. New parts may be used in late production sets only. Stock both original and new parts.
E Other	

Ref. No.	Part No.		Part Name & Description	Pcs/ Set	Note
	Original Part No.	**New Part No.**			
M8 (M29)	PQFW42Z	**PQFW42Y**	Head Base	1	1 B
Z1	------	**PQZZ2060Z**	Locating Tool	1	5

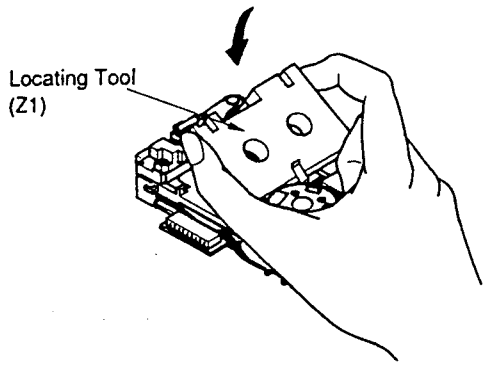
Notes: 1. Perform locating adjustment after changing or moving Erase Head or parts around it.
2. (M29)...Ref. No. of KX-T2740.



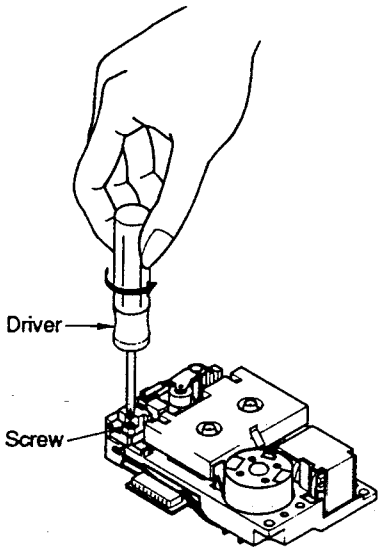
(Locating Tool)

■ LOCATING ADJUSTMENT (for 1 line Cassette Deck)

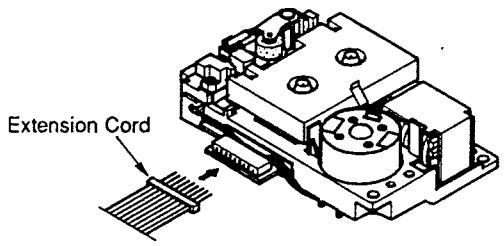
1 • Set the Locating Tool (Z1) on the DECK.



2 • Loosen the fixed screw of Erase Head.

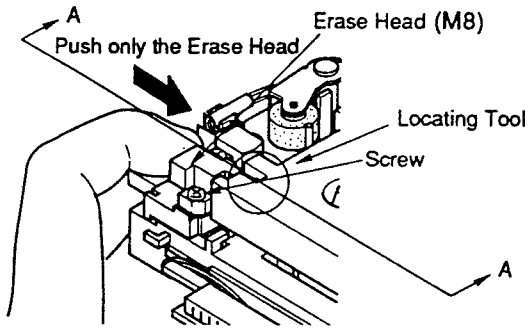


3 • The DECK connect with the unit by extension cord and push the Play Button.



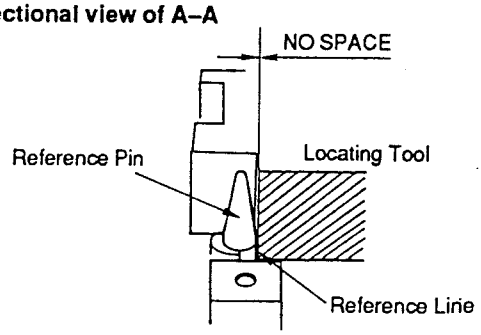
Note: Decks in some models are connected from under it by extension cord.

4 ① Push the back of Erase Head with finger to push only the top of Erase Head (M8) to the side of Locating Tool (Z1).
② Tighten the Erase Head Screw while keeping the state shown in step ①.



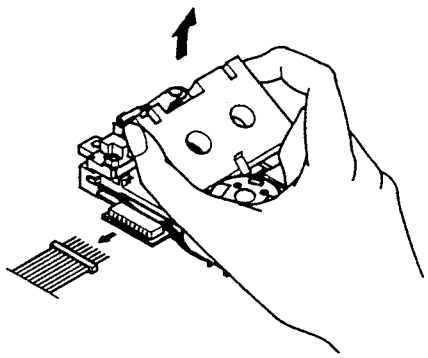
Note 1: Do not give any pressure to another part when you press the Erase Head (M8). Otherwise, the correct justification cannot be made.

●Sectional view of A–A



Note 2: When attaching the Locating Tool to the Reference Pin, be sure to leave NO SPACE between them because the Reference Line is a standard of the deck's dimensions.

5 ① Push the Stop Button.
② Remove the Locating Tool (Z1) and extension cord from the DECK.



ORDER NO. KM4910976851
F1, F7

Service Manual

and Technical Guide

Supplement-1~5,7

KX-T1000, KX-T1440,KX-T1450,
KX-T1455,KX-T1460, KX-T1470
,KX-T1580, KX-T1600,KX-T1740,
KX-T1800,KX-T1920,KX-T2385D,
KX-T2385D-1,KX-T2390-1,KX-T2395,
KX-T2460,KX-T2465,KX-T2470,
KX-T2475,KX-T2630,KX-T2632,
KX-T2634,KX-T4200,KX-T4200-1,
KX-F100,KX-F110,KX-F120,
KX-F155,KX-F195,KX-F3500,
KX-F50, KX-F80, KX-F90,
PAX300H

for U.S.A. | for The Shaper Image

Supplement-1 ..... KX-T1600, KX-T2385D, KX-T2395, KX-T2465, KX-T2634 (for the shaper image) KX-T4200 (for the shaper image)

Supplement-2 ..... KX-T2385D-1, KX-T2390-1, KX-T2470, KX-T2475, KX-T2634(for U.S.A.), KX-T4200-1 KX-F110, KX-F155, KX-F50, KX-F80,

Supplement-3 ..... KX-T1000, KX-T1440, KX-T1455, KX-T1460, KX-T1470, KX-T1740, KX-T2460, KX-F100, KX-F120, KX-F195, KX-F90, PAX300H, KX-F3500,

Supplement-4 ..... KX-T1800, KX-T4200(for U.S.A.)

Supplement-5 ..... KX-T1450,KX-T1580, KX-T1920,KX-T2630

Supplement-7 ..... KX-T2632

• Please use this manual together with the original Service Manuals for the below models.

CHANGES

Subject: Changes of flywheel assembly and chassis mechanism assembly.

Model No.	Order No.
KX-T1000	KM48907951C1
KX-T1440	KM48912099C1
KX-T1450	KM48903870C1
KX-T1455	KM48905914C1
KX-T1460	KM48908977C1
KX-T1470	KM48906927C1
KX-T1580	KM48908975A1
KX-T1600	KM48803650C1
KX-T1740	KM48907952C1
KX-T1800	KM48907970A1
KX-T1920	KM48907953A1
KX-T2385D	KM48806715C1
KX-T2385D-1	KM48810754A1

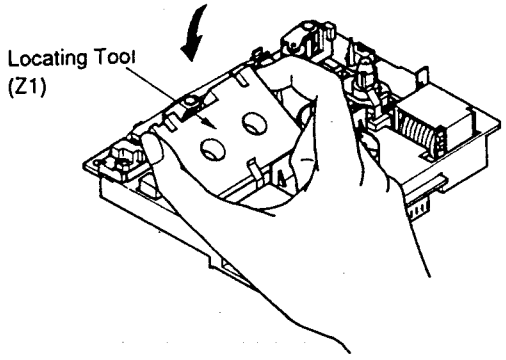
Model No.	Order No.
KX-T2390-1	KM48911061C1
KX-T2395	KM49009263C1
KX-T2460	KM49004203C1
KX-T2465	KM49009264C1
KX-T2470	KM49006227C1
KX-T2475	KM49009267A1
KX-T2630	KM48805687C1
KX-T2632	KM48806698C1
KX-T2634 (for U.S.A.)	KM48907954C1
KX-T2634 (for the shaper image)	KM49004206A1
KX-T4200	KM48808736C1
KX-T4200-1(for U.S.A.)	KM49001135A1

Model No.	Order No.
KX-T4200-1 (for the shaper image)	KM49004204A1
KX-F100	KM48901819C1
KX-F110	KM49101457C1
KX-F120	KM48808742C1
KX-F155	KM49101456A1
KX-F195	KM49010295A1
KX-F3500	KM48811771A1
KX-F50	KM49010294C1
KX-F80	KM48907964C1
KX-F90	KM49009277C1
PAX300H	KM49004193C1

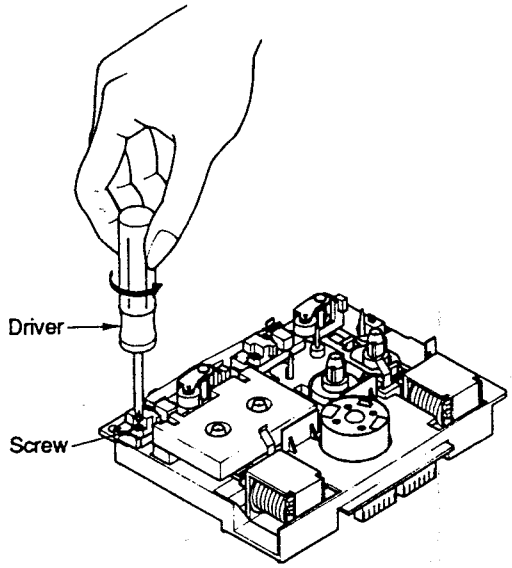
Panasonic

■ LOCATING ADJUSTMENT (for 2 line Cassette Deck)

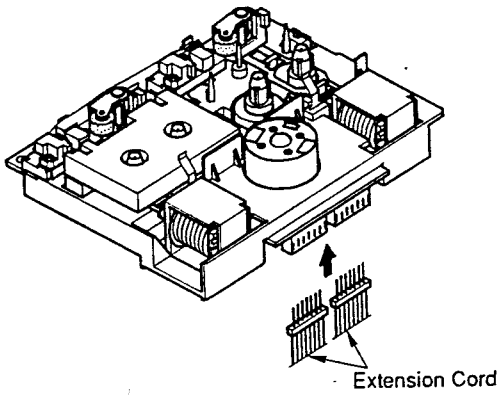
1 • Set the Locating Tool (Z1) on the DECK.



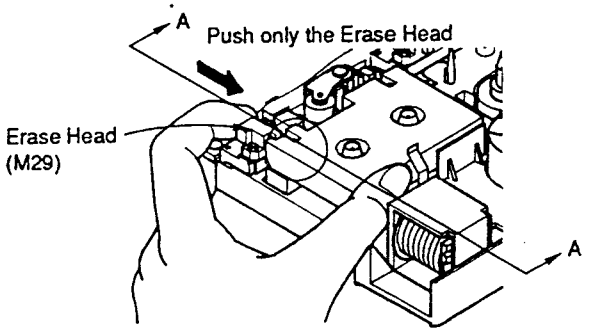
2 • Loosen the fixed screw of Erase Head.



3 • The DECK connect with the unit by extension cord and push the Play Button.

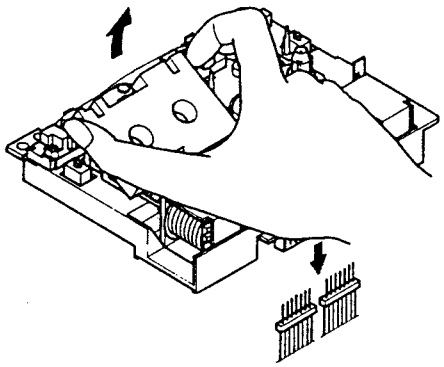


4 ① Push the back of Erase Head with finger to push only the top of Erase Head (M29) to the side of Locating Tool (Z1).
② Tighten the Erase Head Screw while keeping the state shown in step ①.

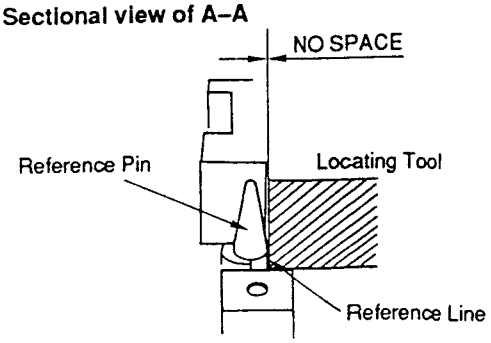


Note 1: Do not give any pressure to another part wher you press the Erase Head (M29). Otherwise, t correct justification cannot be made.

5 ① Push the Stop Button.
② Remove the Locating Tool (Z1) and extension cord from the DECK.



•Sectional view of A–A



Note 2: When attaching the Locating Tool to the Reference Pin, be sure to leave NO SPACE between them because the Reference Line is standard of the deck's dimensions.

Note: Make location adjustment of ICM by following the same procedure as shown above.

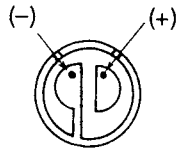
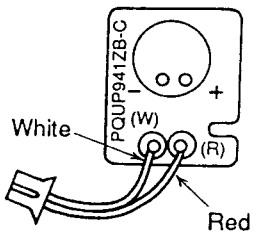
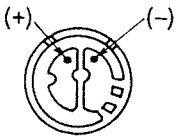
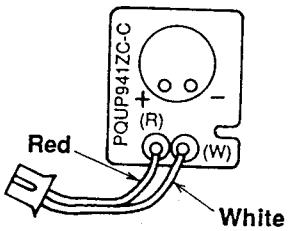
Y (F) M
Printed in

Ref. No.	Original Part No.	New Part No.	Parts Name & Description	Pcs/Set	Remarks	Notes
Digital Board Parts						
LP101	EXEMT220B	**EXCEMT220B**	Noise Filter	1		7
R119	PQ4R10XJ472	**PQ4R10XJ222**	Resistor, 2.2kΩ	1		7
R130	PQ4R10XJ102	**Chip Jumper**	0Ω	1		7
Analog Board Parts						
PCB2	PQWP2F50M	**PQWP2F50M or PQWP2F110M**	Analog Board Ass'y (NLA)	1		4 A
IC6,7	PQVITM41256A	**PQVITM41256A or PQVIHD89711P**	IC	2	S	8 A
C135,136,137, 157	ECQP1H682GZ	**ECQG1H682JZ**	Capacitor, 0.0068µF	4		4 A
C202	--------	**PQCUV1E333MD**	Capacitor, 0.033µF	1		5
R200	--------	**PQ4R10XJ103**	Resistor, 10kΩ	1		5
Operation and Sensor Board Parts						
S108-119,128, 129 ,	PQSH1A33Z	**PQSH1A43Z**	Switch	14		7
Switching Power Supply Board Parts						
Q403	2SD1266P	**2SD1266**	Transistor (Si)	1		7

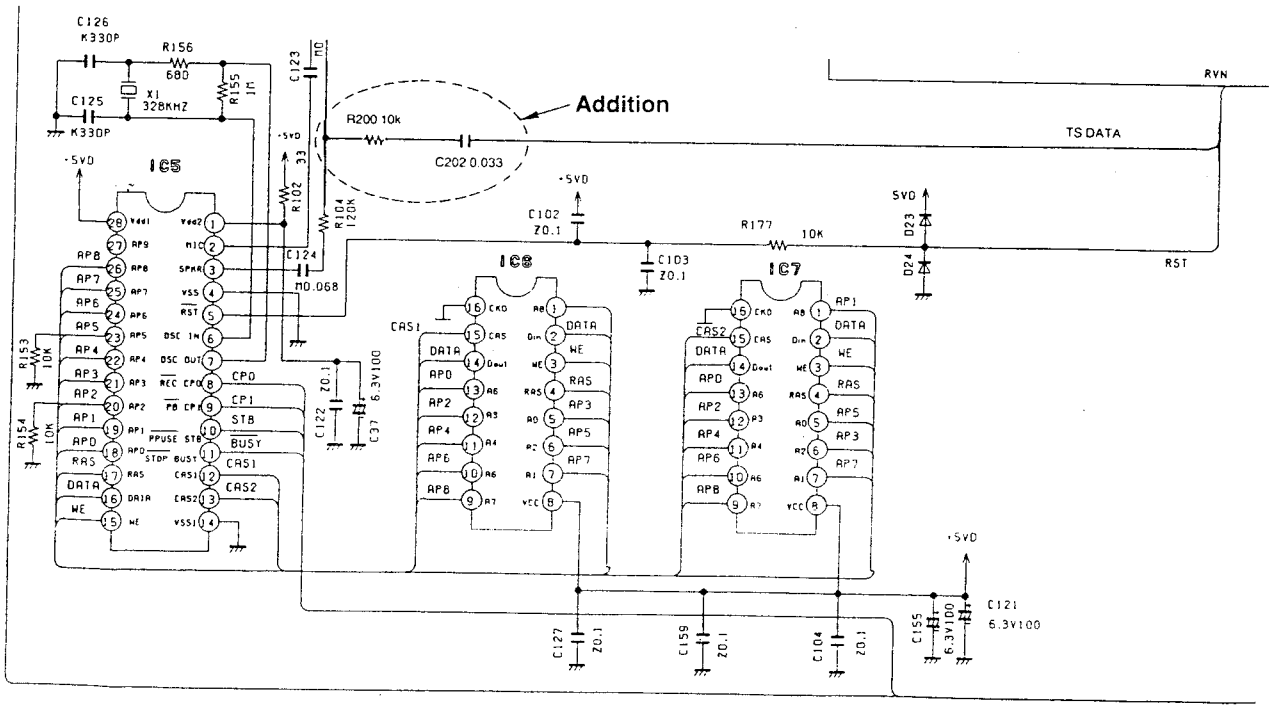
Notes:

1. Ref. No. C202, R200... The C202 and R200 (for the time day stamp) have been added so that the KX-F50/KX-F155 can use the same analog board as used in the KX-F110.

2. Ref. No. 124

Original Part		**New Part**	
Microphone (PQJM120Z)	Mic Board	Microphone **(PQJM124Z)**	Mic Board
			

■ SCHEMATIC DIAGRAM



I Ⓕ KXF155M
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ORDER NO. KM49010294C1
F7

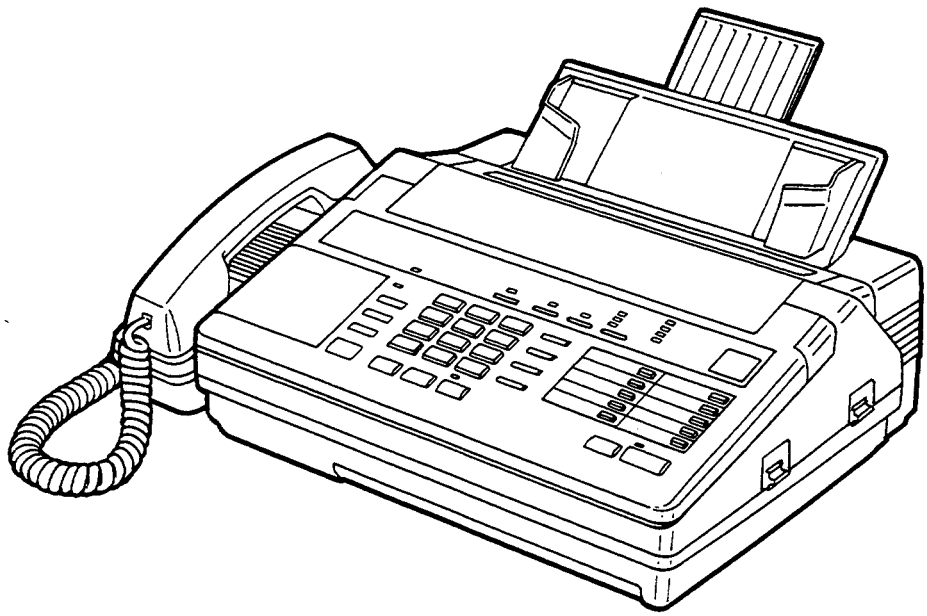
Service Manual

and Technical Guide

TELEPHONE ANSWERING
SYSTEM WITH FACSIMILE

KX-F50

REVISION



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Matsushita Electric
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Panasonic Sales Company,
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of Puerto Rico, Inc.
San Gabriel Industrial Park
65th Infantry Ave. Km.9.5
Carolina, Puerto Rico 00630

When you mention the serial number, write down the 11 digits. The serial number may be found on the bottom of the unit.

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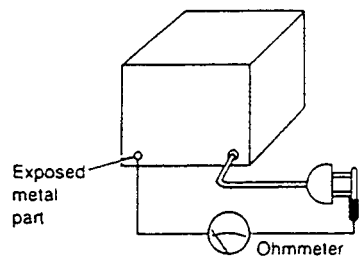
SAFETY PRECAUTIONS

1. Before servicing, unplug the power cord to prevent an electric shock.
2. When replacing parts, use only manufacturer's recommended components for safety.
3. Check the condition of the power cord. Replace if wear or damage is evident.
4. After servicing, be sure to restore the lead dress, insulation barriers, insulation papers, shields, etc.
5. Before returning the serviced equipment to the customer, be sure to make the following insulation resistance test to prevent the customer from being exposed to a shock hazard.

INSULATION RESISTANCE TEST

1. Unplug the power cord and short the two prongs of the plug with a jumper wire.
2. Turn on the power switch.
3. Measure the resistance value with ohmmeter between the jumpered AC plug and each exposed metal cabinet part, such as screwheads, control shafts, handle brackets, etc.
   ***Note:** Some exposed parts may be isolated from the chassis by design. These will read infinity.
4. If the measurement is outside the specified limits, there is a possibility of a shock hazard. The equipment should be repaired and rechecked before it is returned to the customer.



Resistance=Approx 1 MΩ

FOR SERVICE TECHNICIANS

ICs and LSIs are vulnerable to static electricity.
When repairing, the following precautions will help prevent recurring malfunctions.
1) Cover the plastic parts boxes with aluminum foil.
2) Ground the soldering irons.
3) Use a conductive mat on the worktable.
4) Do not grasp IC or LSI pins with bare fingers.

SPECIFICATIONS

1. Integrated Telephone System (ITS) Section

Type:	K type handset, Single line ITS
	Push button type 12 key dial pad
Function:	Line monitor (Volume control type)
	10 stations automatic dialer (30 digits)
	Auto redial
	Combination dialing
	20 speed dialer
	Ringer control (3-steps control type)
	Pulse dialing or DTMF (Tone) Dialing

2. AutomaticTelephone Answering System (ATAS) Section

Type:	1 micro cassette automatic logic control mode
	Semiconductor record/playback mode OGM
	DTMF tone remote control
Function:	Remote turn on
	Message memo (Remote record/playback type)
	2 way record
	Call counter (Remote listening)
	Operation selectable 3 digits ID code
	CPC control
	TEL/FAX TAD/FAX selector

3. Facsimile Section

Type:	Desk top
Applicable Lines:	Public switched telephone network
Compatibility:	CCITT G3
Document Size:	MAX. 8 1/2" (216 mm) in width, MAX. 23 5/8" (600 mm) in length
Effective Scanning Width:	MAX. 8 3/16" (208 mm)
Printing Paper Size:	8 1/2" (letter) x 98ft roll (216 mm x 30 m roll)
Effective Printing Width:	8 3/16" (208 mm)
Transmission Time:	Approx. 30 sec/page (G3 Normal mode)
	Approx. 17 sec/page (Original mode)
Scanning Density:	Horizontal 203 pels/inch (8 pels/mm)
	Vertical 98 lines/inch (3.85 lines/mm)-Standard
	196 lines/inch (7.7 lines/mm)-Fine
Image Sensor Type:	CCD image sensor
Printer Type:	Thermal printer
Data Compression System:	Modified Huffman (MH)
Modem Speed:	9600/7200/4800/2400 bps; Automatic fallback
Function:	10 stations automatic transmission
	Automatic document feeder (Max. 10 page), Polling

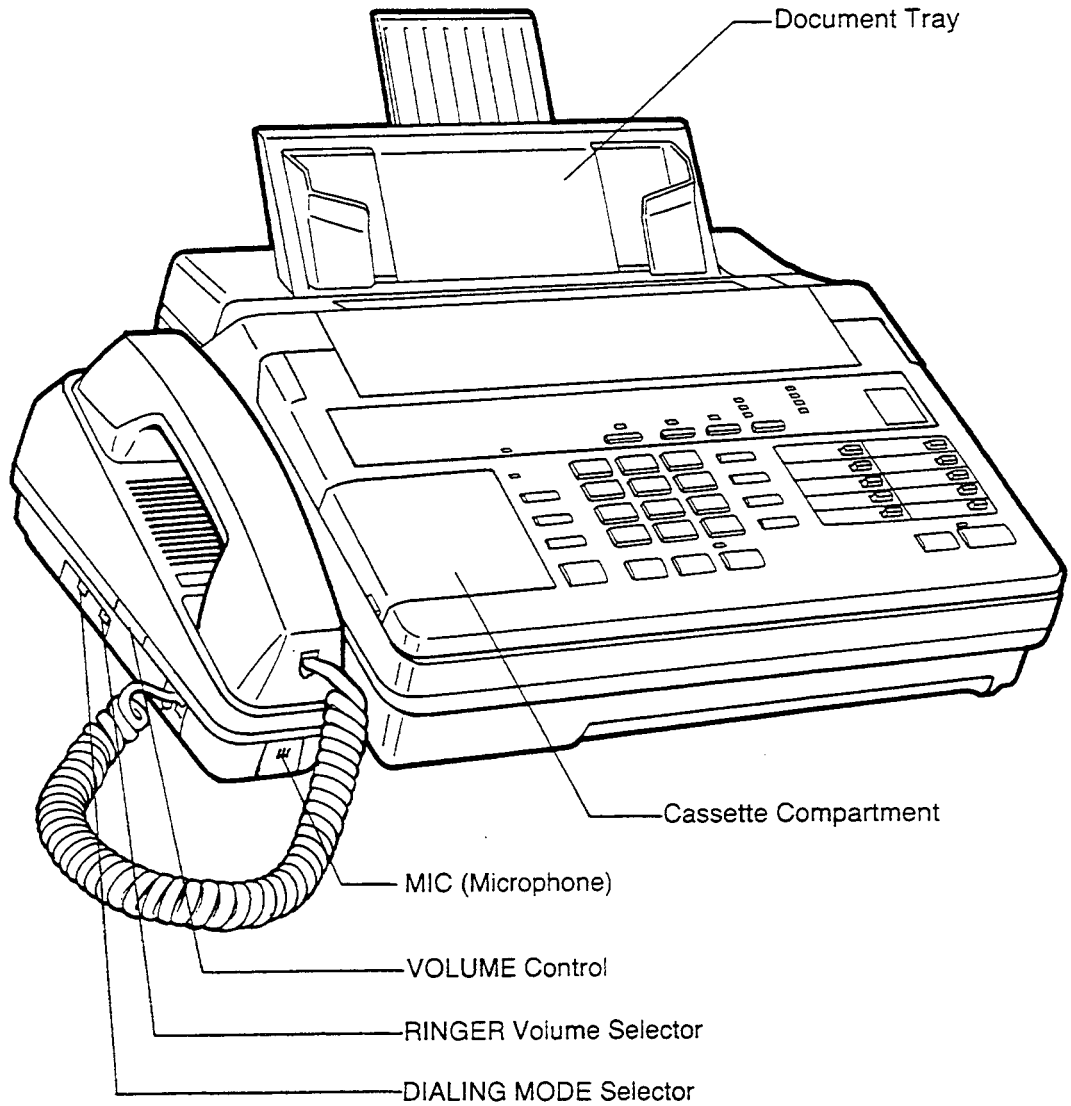
4. General

Power Supply:	AC 120V, 60Hz
Power Consumption:	65W
	Battery 3V (Lithium Battery)...for Memory Backup
Speaker:	1 31/32" (5 cm) PM dynamic
Microphone:	Condensor microphone (for OGM record)
Dimensions (H x W x D):	4 29/32" x 16 7/8" x 9 9/32" (125 x 429 x 312 mm)
Weight:	11 lb 7.4 oz. (5.2kg)

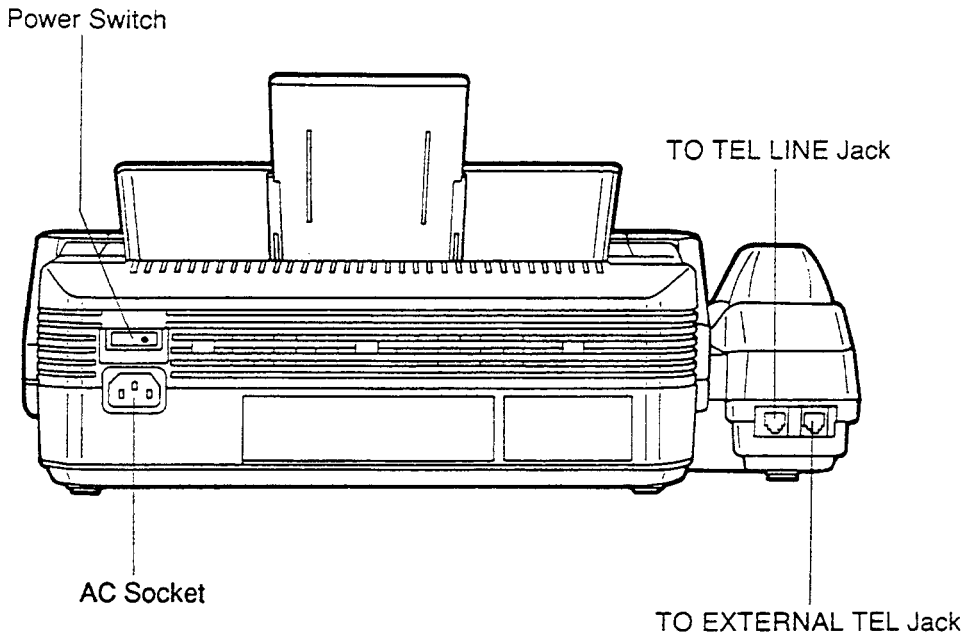
Design and specifications are subject to change without notice.

LOCATION OF CONTROLS

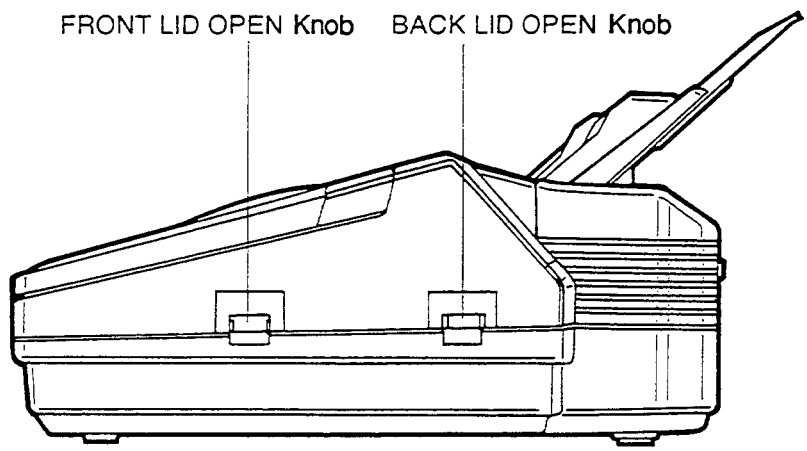
Front view

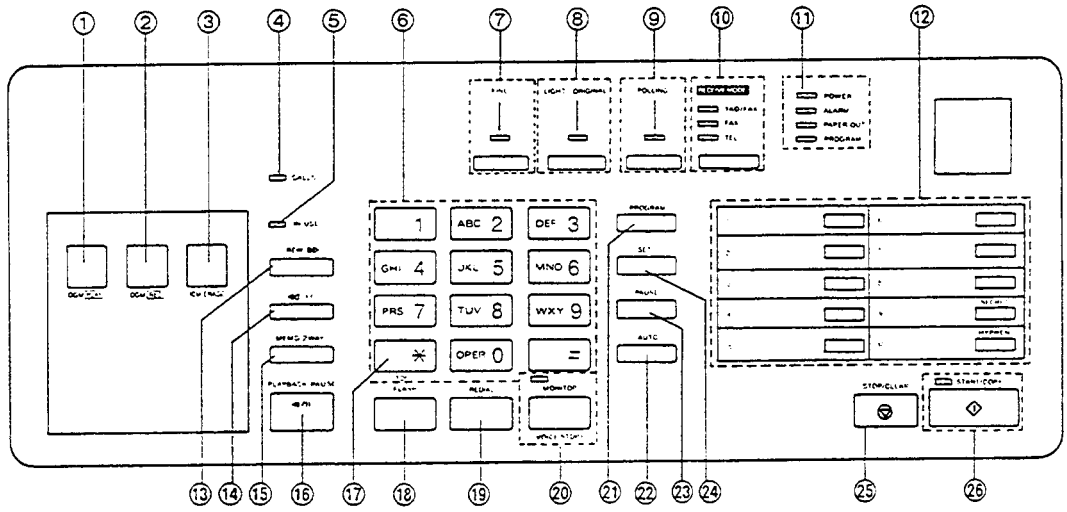


Rear view



Side view





① OGM PLAY Button: Used to replay your outgoing message.

② OGM REC Button: Used to record your outgoing message.

③ ICM ERASE Button: Used to erase recorded incoming messages at high speed.

④ CALLS Indicator: The indicator flashes to show the number of incoming messages recorded.

⑤ IN USE Indicator: The indicator lights or flashes when the answering device is in use.

⑥ Dial Keypad: Used to dial or program numbers.

⑦ FINE Button and Indicator: Used to set the scanning line density. The indicator lights when this feature is on.

⑧ LIGHT ORIGINAL Button and Indicator: Used to transmit or copy originals with faint writing. The indicator lights when this feature is on.

⑨ POLLING Button and Indicator: Used for Polling Function. The indicator lights when Polling Function is being set.

⑩ RECEIVE MODE Button and Indicators: Used to select the desired receiving mode. The indicators light to show the mode in which the unit is set.

⑪ POWER Indicator: The indicator lights when the POWER switch is turned on.

ALARM Indicator: The indicator lights when any trouble occurs.

PAPER OUT Indicator: The indicator lights when the recording paper roll is empty.

PROGRAM Indicator: The indicator lights or flashes when you are programming the unit.

⑫ Direct Call Station Keys: Used for One touch dialing.

⑬ **REW (REWIND) Button:**	Used to run the tape quickly backwards to a desired point.
⑭ **FF (FAST FORWARD) Button:**	Used to run the tape quickly forwards to a desired point.
⑮ **MEMO/2WAY Button:**	Used to start and stop recording of a memo message or a telephone conversation.
⑯ **PLAYBACK/PAUSE Button:**	Used to play back recorded messages, or interrupt playback or FF/REW operation.
⑰ **TONE Button**	Used to change the dialing mode from pulse to tone during a dialing operation.
⑱ **FLASH Button:**	Used to access some features of your host PBX.
⑲ **REDIAL Button:**	Used to redial the last dialed number.
⑳ **MONITOR (VOICE STDBY) Button and Indicator:**	Used for on-hook dialing and voice contact features. The indicator lights when these functions are on.
㉑ **PROGRAM Button:**	Used to start or end programming functions.
㉒ **AUTO Button:**	Used for speed dialing.
㉓ **PAUSE Button:**	Used to insert a pause into a facsimile telephone number during programming.
㉔ **SET Button:**	Used to store parameters during programming.
㉕ **STOP/CLEAR Button:**	Used to cancel transmission or copy operation. Also used during programming to clear the previously entered parameters.
㉖ **START/COPY Button and Indicator:**	Used to start transmission and copy functions. The indicator lights when these functions are on.

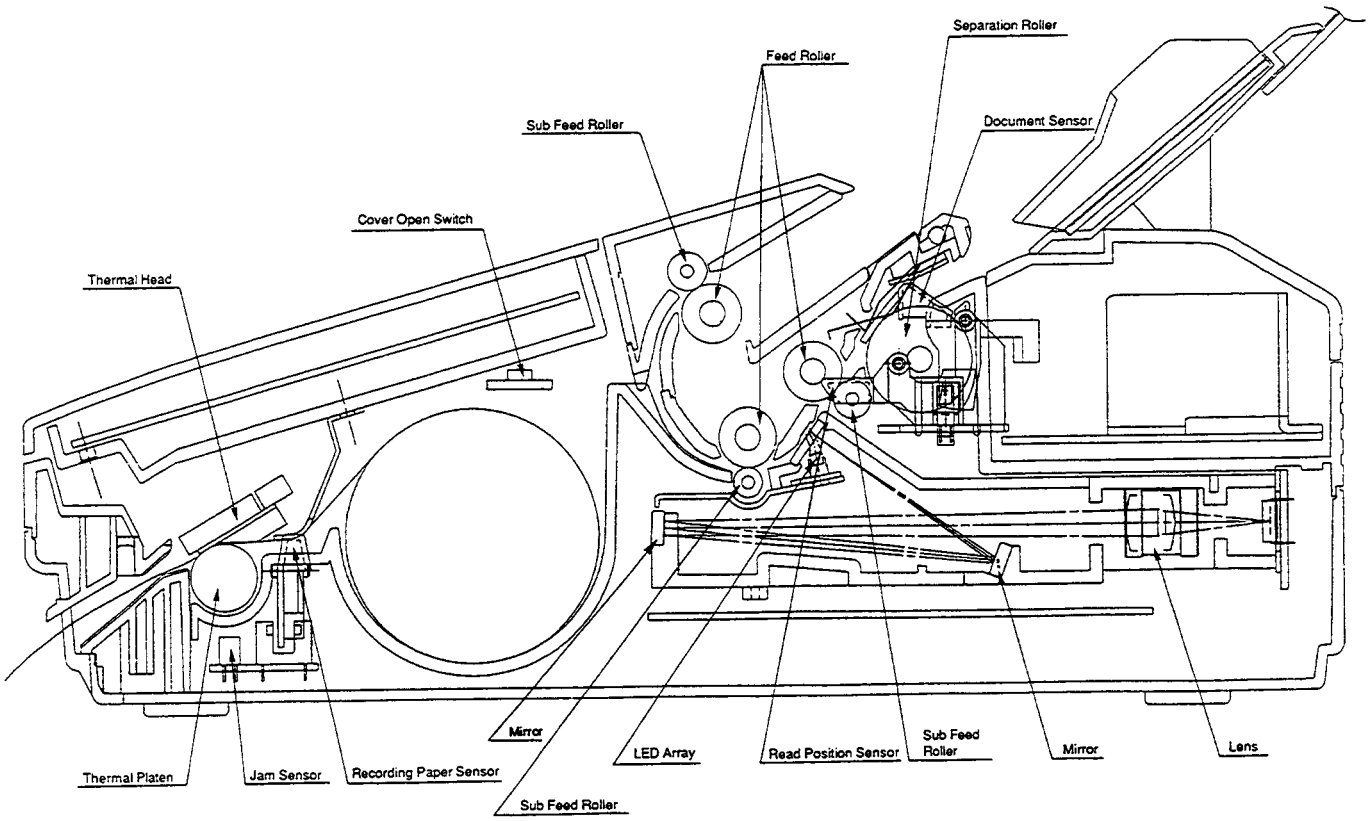
MAINTENANCE ITEM

1. OUTLINE

MAINTENANCE AND REPAIRS ARE PERFORMED USING THE FOLLOWING STEPS.

1) **Periodic maintenance**
   Inspect the equipment periodically and if necessary, clean any contaminated parts.
2) **Check for breakdowns**
   Look for signs of trouble and consider how the problems arose.
   If the equipment can still be used, perform a copying, self testing or communications testing.
3) **Check equipment**
   Perform a copying, self testing and communications testing to determine if the problem originates from the transmitter, the receiver or the telephone line.
4) **Determine causes**
   Determine the causes of equipment trouble by troubleshooting.
5) **Equipment repairs**
   Repair or replace the defective parts and take appropriate measures at this stage to ensure that the problem does not recur.
6) **Confirm normal operation of the equipment**
   After completing the repairs, conduct copying, self testing and communications testing to confirm that the equipment operates normally.
7) **Record keeping**
   Make a record of the measures taken to rectify the problem for future reference.

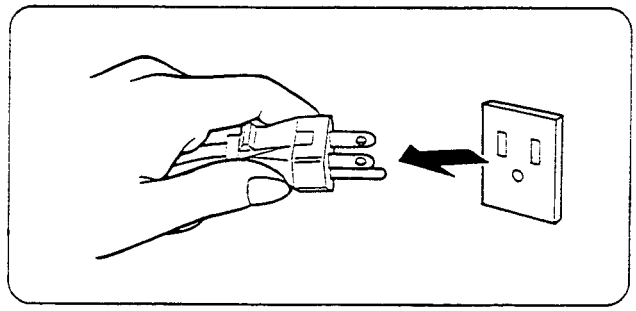
2. MAINTENANCE CHECK ITEM



NO.	OPERATION	CHECK ITEM	REMARKS
1	Document Path	Remove any foreign matter such as paper.	-----
2	Rollers	If the roller is dirty, clean it with a damp cloth then dry thoroughly.	See page 11.
3	Thermal Platen	If the platen is dirty, clean its with a damp cloth then dry thoroughly. Remove the piece of paper.	See page 11.
4	Thermal Head	If the thermal head is dirty, clean the printing surface with a cloth moistened with denatured alcohol (alcohole without water), then dry thoroughly.	See page 11.
5	LED Array	If the LED Array is dirty, clean the glass dry soft cloth.	See page 11.
6	Sensor & Switch	Jam Sensor(PC801), Recording Paper Sensor(PC802), Document Sensor(PC701), Read position Sensor (PC702), Cover Open Switch (SW901). Confirm operation of sensor.	Pages 26-28.
7	Mirrors and Lens	If the mirror and lens are dirty, clean its with a dry soft cloth.	-----
8	Cassette Deck	If the capstan, pinch roller and heads, clean its.	See page 10.
9	Abnormal, wear and tear or looseness of parts	Exchange the part. Check the tightness of screws on each parts.	-----

3. MAINTENANCES

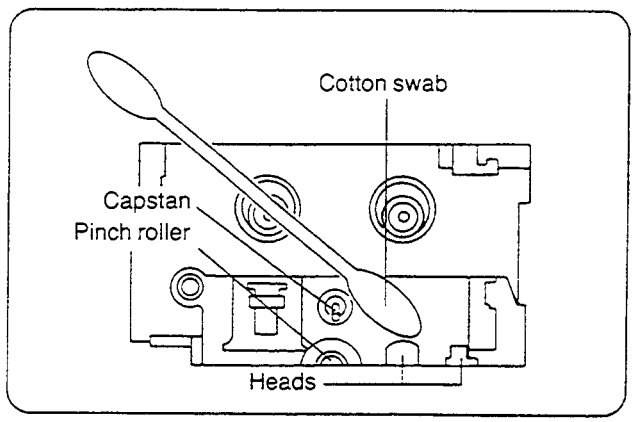
Be sure that the AC plug is disconnected from the outlet before performing any maintenance.



Cassette deck

Since the head and capstan assemblies are in contact with the tape, dirt and residue from the tape may easily adhere to these parts, causing distortion. Clean these parts periodically in the manner described below for the best sound quality.

Clean the head surfaces, pinch roller and capstan with a cotton swab.
If these surfaces are extremely dirty, wipe them with a cotton swab dampened with alcohol, then wipe them with a dry soft cloth.



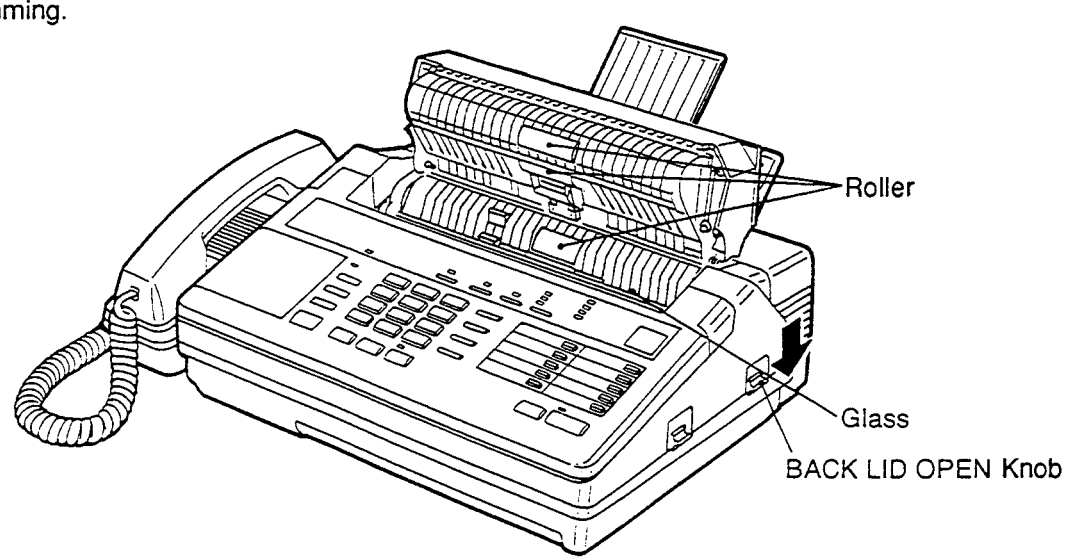
Note:

- Do not bring magnetic or metal objects , such as a screwdriver, near the head assembly, as such objects could magnetize the heads.
- Do not oil any part of the unit.

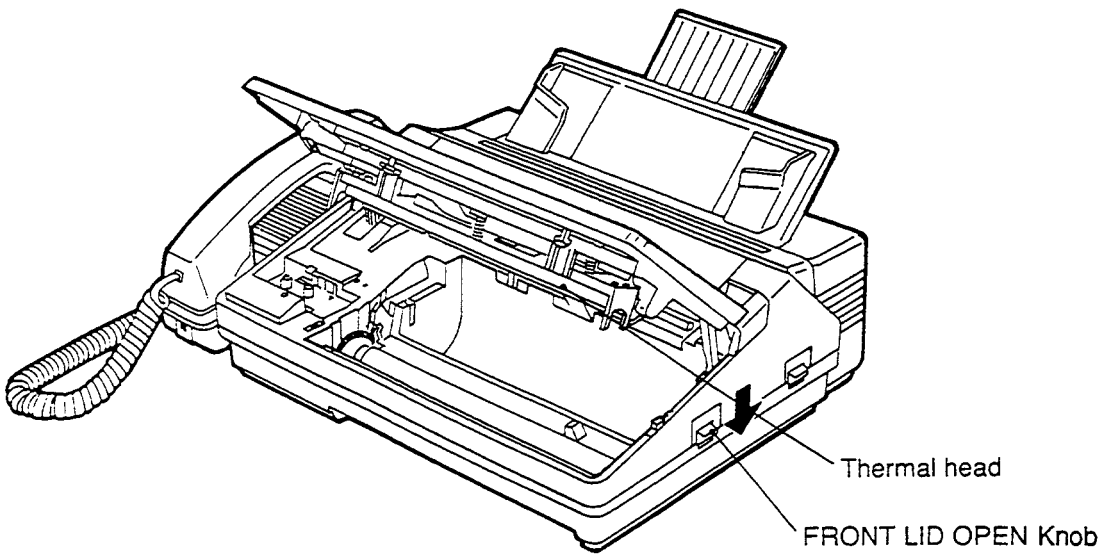
Facsimile machine

If a streak or a dirty pattern appears on a copied, transmitted or received document;

1. Clean the glass with a dry soft cloth.
2. Clean the roller with a damp cloth then dry thoroughly to prevent the paper from jamming.



If you cannot get a clear copy after performing the above steps 1 and 2, clean the thermal head with a cloth moistened with denatured alcohol (alcohol without water), then dry thoroughly. To prevent malfunction due to static electricity, do not use a dry cloth and do not touch the thermal head with your finger directly.



TROUBLESHOOTING GUIDE

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1. TEST MODE

Test Mode	Function	Operation
1. Printer Test	Print a test pattern and check the thermal head for abnormalities (missing dots, etc.) and also check the operation of the reception motor.	1. Press the PROGRAM button. 2. Press the #, 4 and 2 buttons. 3. Press the START button.
2. Motor Test	Rotate the transmission and reception motors to check the operation of the motors.	1. Press the PROGRAM button. 2. Press the #, 9, 0, 0, 0 and ✕ buttons. 3. Press the 5 and 6 buttons. 4. Press the START button. 5. Press the STOP/CLEAR button.
3. Modem Test	Send four kinds of FAX signals to check the sending function of the modem. 1) 462 Hz: Consecutive signal of PIS for tonal process. 2) 1100 Hz: Consecutive signal of EOM for tonal. 3) 2100 Hz: G2 carrier signal Consecutive of CED signal 4) G3, V29 training signal [modulation wave of carrier signal (1700 Hz)]	1. Press the PROGRAM button. 2. Press the #, 9, 0, 0, 0 and ✕ buttons. 3. Press the 5 and 4 buttons. 4. Press the START button. (every time press; 462 Hz→1100 Hz→2100 Hz→V29) 5. Press the STOP/CLEAR button.
4. Scanner Test	Turn on the LED lamp for document and operate the read system (there is no need to use paper). Observe the signals obtained to check the read system.	1. Press the PROGRAM button. 2. Press the #, 9, 0, 0, 0 and ✕ buttons. 3. Press the 5 and 5 buttons. 4. Press the START button. 5. Press the STOP/CLEAR button.
5. ROM Check	Check the ROM (IC102) by means of a check sum to see if the contents have been destroyed and also to check the version.	1. Press the PROGRAM button. 2. Press the #, 9, 0, 0, 0 and ✕ buttons. 3. Press the 5 and 1 buttons. 4. Press the START button.
6. RAM Check (Memory Clear)	The read and write operations of the RAMs (IC103, 502) can be checked to see whether or not the contents have been destroyed. **Note:** Before servicing, you must print the telephone and system list and keep the printouts as the memory will be cleared when the RAM is checked.	1. Press the PROGRAM button. 2. Press the #, 9, 0, 0, 0 and ✕ buttons. 3. Press the 5 and 0 buttons. 4. Press the START button.

2. SERVICE HINTS

SYMPTOM	CURE
1. Defective general ATAS/ITS operation.	Defective solder of IC15 or check solder short.
1) Defective OGM record/playback.	Replace IC5 → IC6 → IC7.
2) Does not pull the plunger.	Replace Q27 and Q29.
3) Holds line constantly.	Replace Q6 and SA1.
4) ICM will not cut off.	Check R86, R124, C106 and C108.
5) Does not rewind.	Check Q22, Q23 and Q24.
6) Does not fast forward.	Check Q20.
2. Other defective operation.	Defective solder of IC301 or IC501, check short of solder. (Refer to pages 22 and 23.)

3. SERVICE FUNCTION TABLE

OPERATION:
1. Press the PROGRAM button.
2. Press the #, 9, 0, 0, 0 and ✳ buttons.
3. Input the code No.
4. Set the range (number).
5. Press the SET button. (An exception of code No. 50, 51, 54~57.)

Code	Function	Set Value	Effective Range	Default	Remarks
01	Pause time set	×100 ms.	000~600	050	
02	Flash time set	×10 ms.	01~99	70	
03	Dial speed select	1..10PPS 2..20PPS	1, 2	1	
10	VOX time select	1..6 seconds 2..4 seconds	1, 2	1	
20	CED frequency select	1..2100 Hz 2..1100 Hz	1, 2	1	
21	International mode select	1..On 2..Off	1, 2	1	
22	Auto recovery select	1..On 2..Off	1, 2	1	
23	Receive equalizer select	1..0.0 Km 2..1.8 Km 3..3.6 Km 4..7.2Km	1~4	2	
24	Transmit equalizer select	1..0.0 Km 2..1.8 Km 3..3.6 Km 4..7.2Km	1~4	2	
50	Memory clear (Refer to page 13.) Returns the set values of #1~#34 (#30~E34: user selectable) to default				"START/COPY" input
51	ROM check (Refer to page 13.)				"START/COPY" input
52	DTMF single tone transmit select	1...On 2..Off	1, 2	2	Refer to page 15.
53	Monitor on FAX communication select	1..all phases 2..phase B 3..Off	1~3	3	
54	Modem test (Refer to page 13.)				"START/COPY" input
55	Scanner test (Refer to page 13.)				"START/COPY" input
56	Motor test (Refer to page 13.)				"START/COPY" input
57	LED test				"START/COPY" input
59	Paper jam detection select	1..On 2..Off	1, 2	1	
60	Cutter select	1..1 per page 2..2 per call 3..Off	1~3	1	
63	CCD position adjustment value set	×1 mm	−20~20	00	Press "*" for entering negative values.
70	BREAK % select	1..61% 2..67%	1, 2	1	
71	ITS auto redial time set	×number of times	00~99	14	
72	ITS auto redial line disconnection time set	× second	001~999	30	
73	Remote turn-on ring number set	×number of rings	00~99	15	

Code	Function	Set Value	Effective Range	Default	Remarks
80	TAM sequential tone detection select	1..On 2..Off	1, 2	1	
82	2-way recording select	1..Enable 2..Disable	1, 2	1	
83	2-way beep time set	×10 ms.	00~99	17	
84	Initial OGM reload select	1..On 2..Off	1, 2	1	
86	White line skip 1 select	1..On 2..Off	1, 2	1	
87	White line skip 2 select	1..On 2..Off	1, 2	1	
90	FAX auto redial time set	×number of times	00~99	05	
91	FAX auto redial line disconnection time set	×second	001~999	045	
92	CNG transmit select	1..auto/manual 2..auto 3..Off	1~3	1	
93	Time between CED and 300 bps	×10 ms.	006~999	008	
94	Overseas DIS detection select	1..detects at the 1st time 2..detects at the 2nd time	1, 2	1	
95	Receive error limit value set	×number of times	000~999	100	
96	Transmit level set	× dBm	−15~00	10	The values entered without "minus sign" will be regarded as negative.
97	Transmit speed fixed mode select	1..9600BPS 2..7200BPS 3..4800BPS 4..2400BPS 5..Off	1~5	5	
----	User setting list output				"START/COPY" input (If pressed down for more than 3 seconds, codes will also be output.)
74	Dial Tone Defection set	1. On 2. Off	1, 2	2	
81	ICM Tape End Defection set	1. Off 2. Off	1, 2	2	

DTMF single tone transmit select.
When set to ON (=1), the 12 keys and transmission frequencies are as shown.

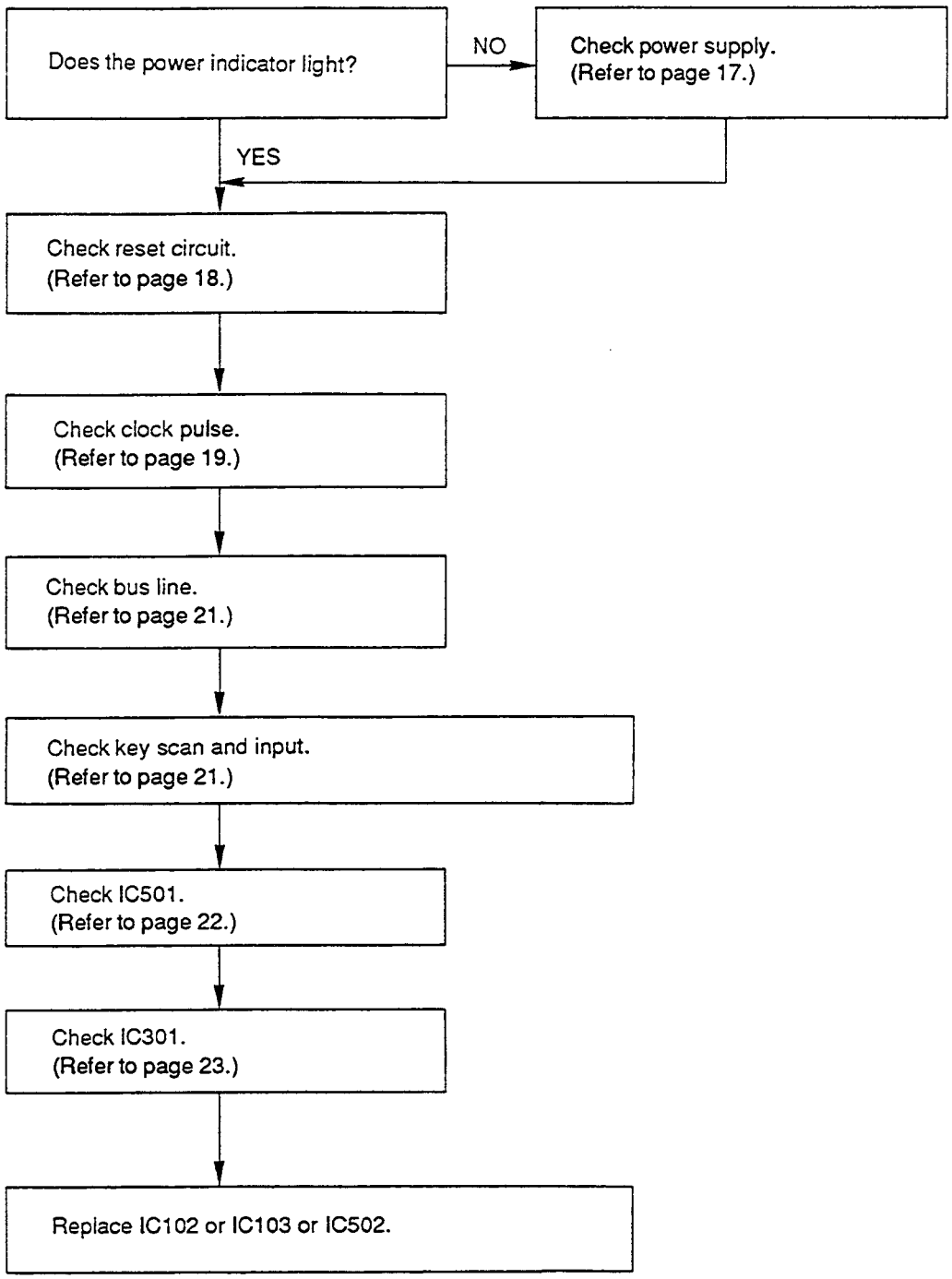
Key	Frequency(Hz)	Key	Frequency(Hz)
"1"	697	"5"	1209
"2"	770	"6"	1366
"3"	852	"7"	1477
"4"	941		

When set to OFF (=2), the 12 keys and transmission frequencies are as shown.

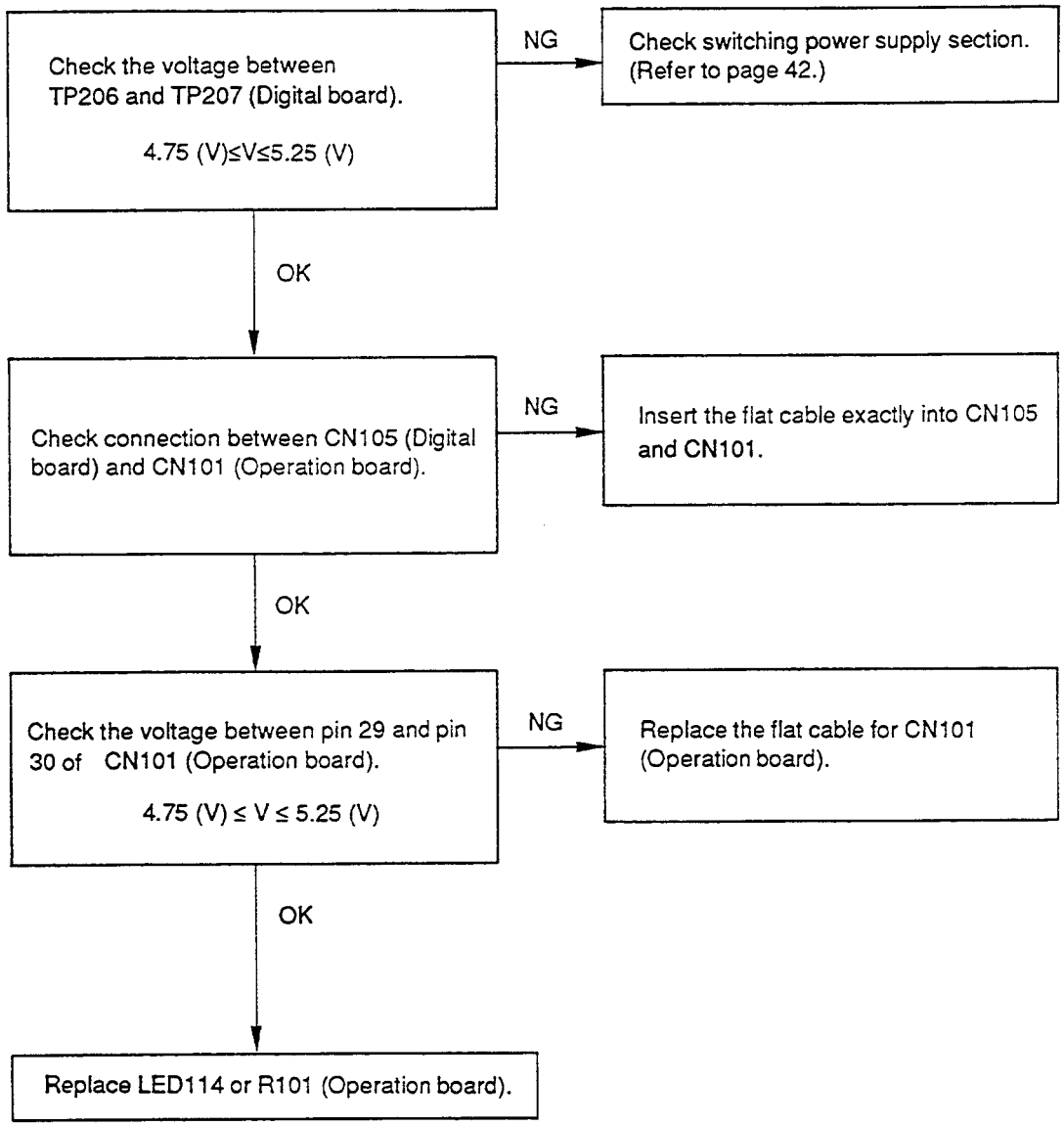
Low(Hz) \ High(Hz)	1209	1366	1477
697	"1"	"2"	"3"
770	"4"	"5"	"6"
852	"7"	"8"	"9"
941	"*"	"0"	"#"

4. GENERAL

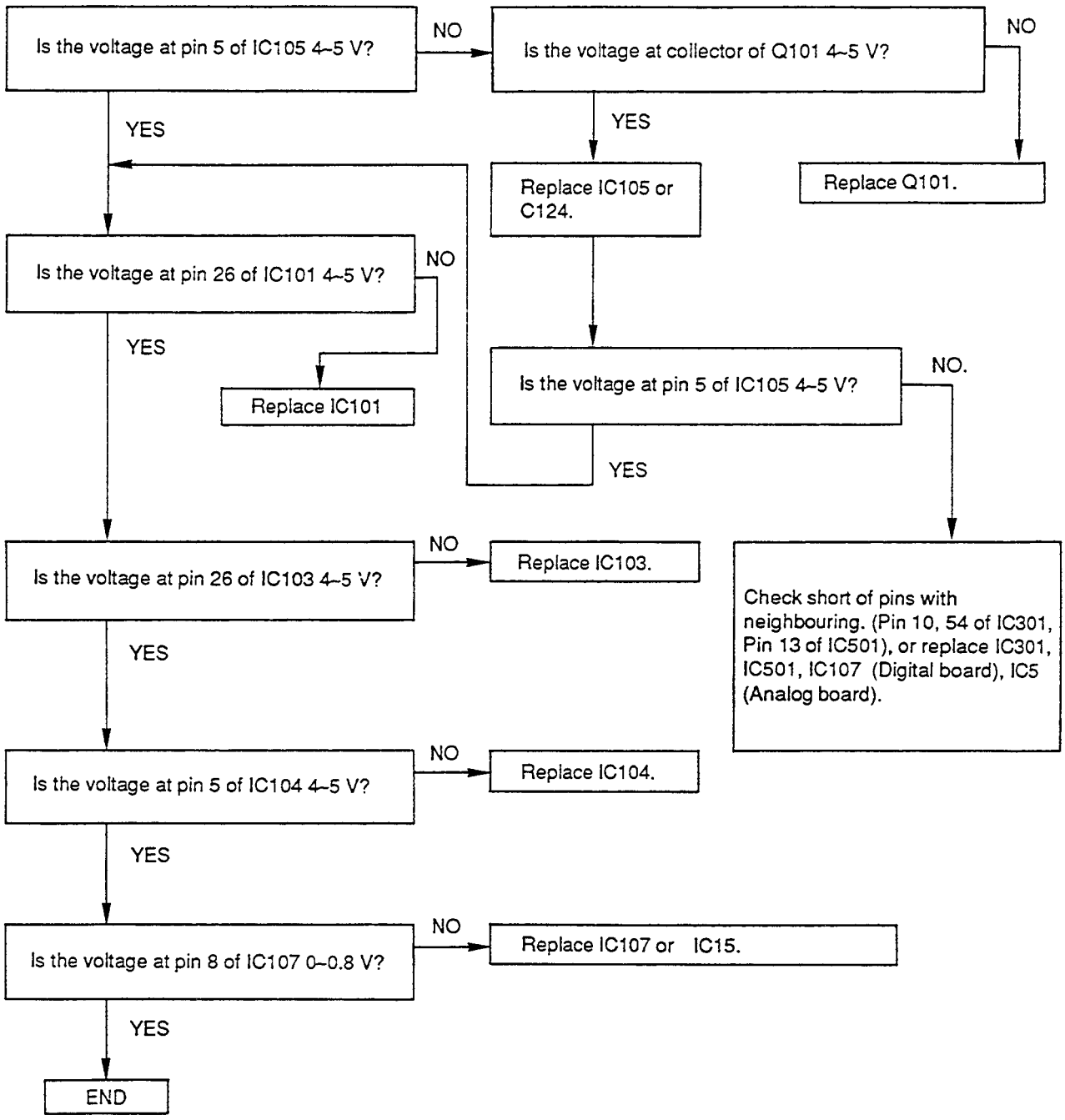
4-1. UNIT DOES NOT WORK



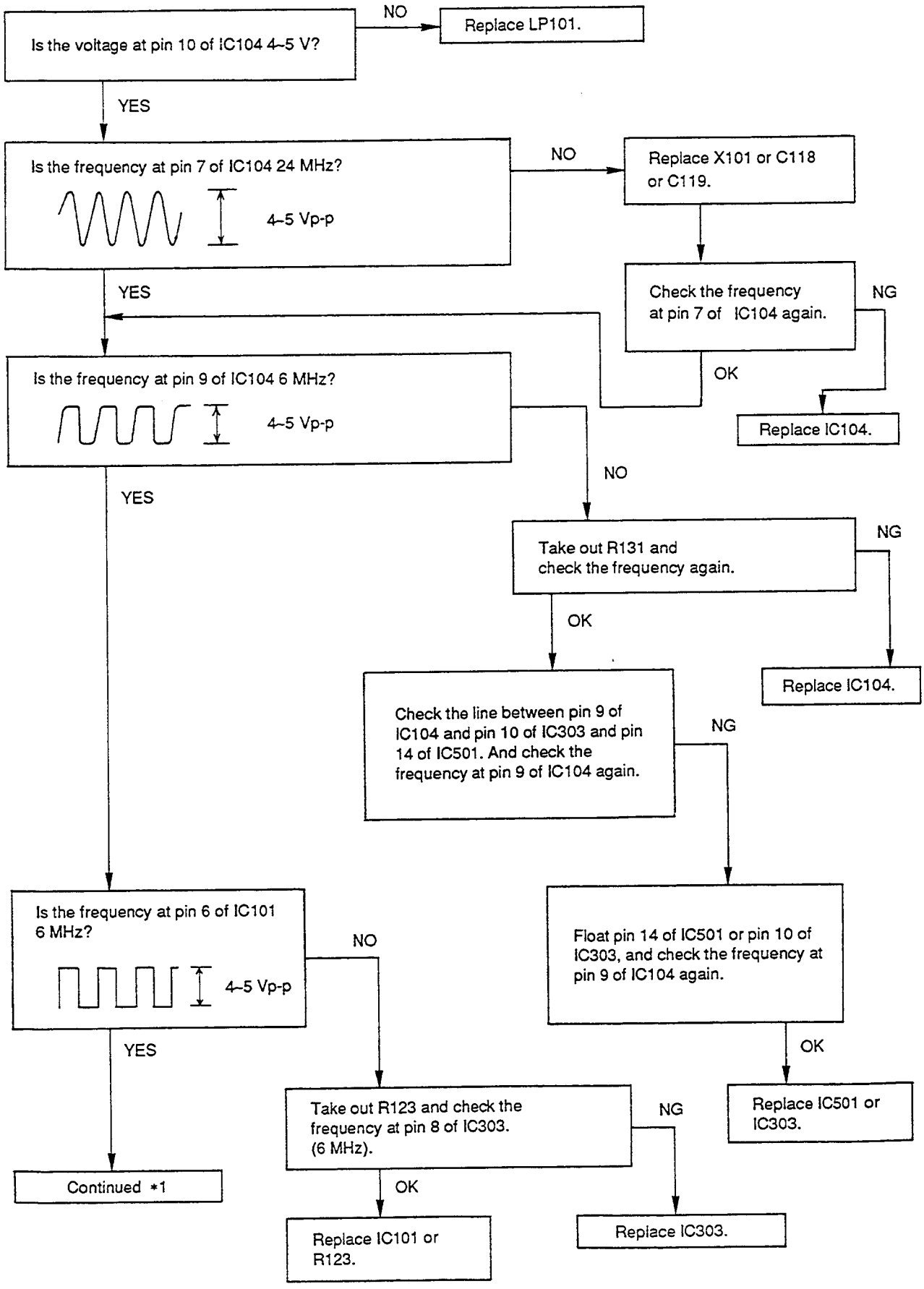
Note 1) Check power supply

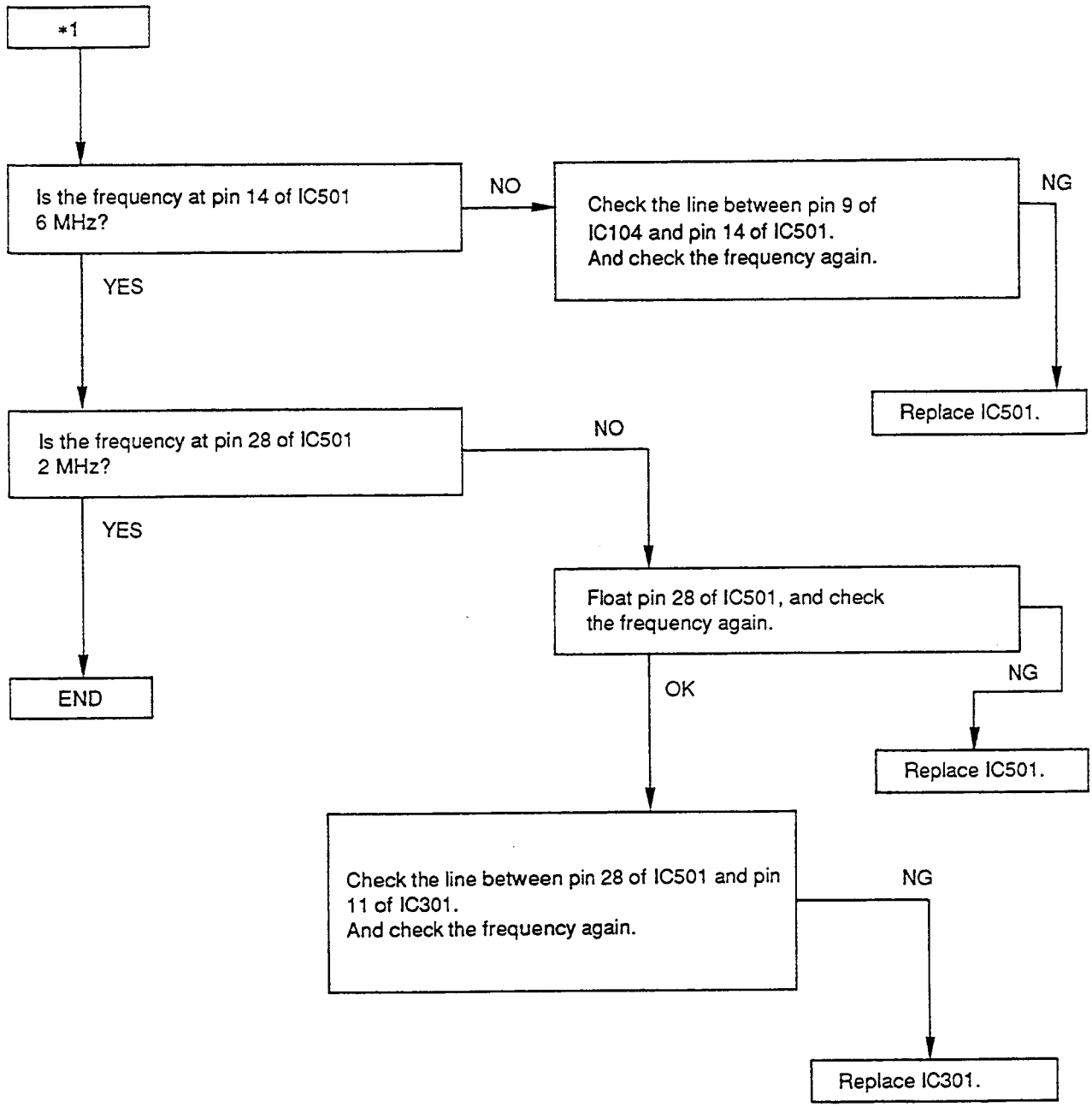

Check the voltage between TP206 and TP207 (Digital board).
4.75 (V)≤V≤5.25 (V)
NG
Check switching power supply section. (Refer to page 42.)
OK
Check connection between CN105 (Digital board) and CN101 (Operation board).
NG
Insert the flat cable exactly into CN105 and CN101.
OK
Check the voltage between pin 29 and pin 30 of CN101 (Operation board).
4.75 (V) ≤ V ≤ 5.25 (V)
NG
Replace the flat cable for CN101 (Operation board).
OK
Replace LED114 or R101 (Operation board).

Note 2) Check reset circuit

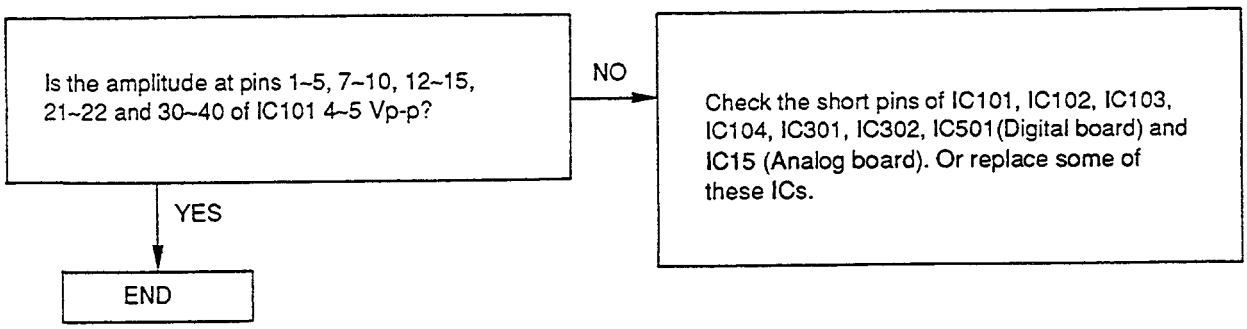

Is the voltage at pin 5 of IC105 4~5 V?
NO
Is the voltage at collector of Q101 4~5 V?
NO
YES
YES
Replace IC105 or C124.
Replace Q101.
Is the voltage at pin 26 of IC101 4~5 V?
NO
YES
Replace IC101
Is the voltage at pin 5 of IC105 4~5 V?
NO.
YES
Is the voltage at pin 26 of IC103 4~5 V?
NO
Replace IC103.
Check short of pins with neighbouring. (Pin 10, 54 of IC301, Pin 13 of IC501), or replace IC301, IC501, IC107 (Digital board), IC5 (Analog board).
YES
Is the voltage at pin 5 of IC104 4~5 V?
NO
Replace IC104.
YES
Is the voltage at pin 8 of IC107 0~0.8 V?
NO
Replace IC107 or IC15.
YES
END

Note 3) Check clock pulse

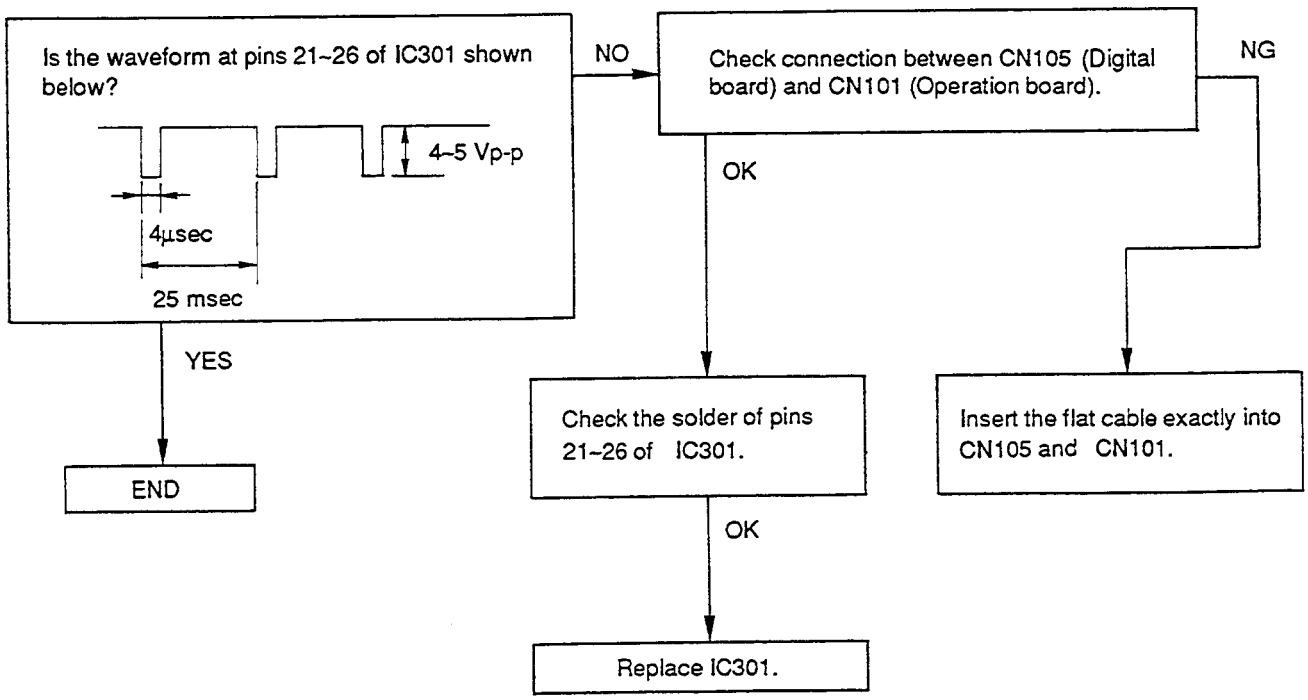

Is the voltage at pin 10 of IC104 4–5 V?
NO
Replace LP101.
YES
Is the frequency at pin 7 of IC104 24 MHz?
4–5 Vp-p
NO
Replace X101 or C118 or C119.
Check the frequency at pin 7 of IC104 again.
NG
OK
YES
Is the frequency at pin 9 of IC104 6 MHz?
4–5 Vp-p
Replace IC104.
NO
YES
Take out R131 and check the frequency again.
NG
OK
Replace IC104.
Check the line between pin 9 of IC104 and pin 10 of IC303 and pin 14 of IC501. And check the frequency at pin 9 of IC104 again.
NG
Is the frequency at pin 6 of IC101 6 MHz?
4–5 Vp-p
NO
Float pin 14 of IC501 or pin 10 of IC303, and check the frequency at pin 9 of IC104 again.
OK
YES
Take out R123 and check the frequency at pin 8 of IC303. (6 MHz).
NG
Replace IC501 or IC303.
Continued *1
OK
Replace IC101 or R123.
Replace IC303.


*1
Is the frequency at pin 14 of IC501 6 MHz?
NO
Check the line between pin 9 of IC104 and pin 14 of IC501. And check the frequency again.
NG
Replace IC501.
YES
Is the frequency at pin 28 of IC501 2 MHz?
NO
YES
END
Float pin 28 of IC501, and check the frequency again.
NG
Replace IC501.
OK
Check the line between pin 28 of IC501 and pin 11 of IC301. And check the frequency again.
NG
Replace IC301.

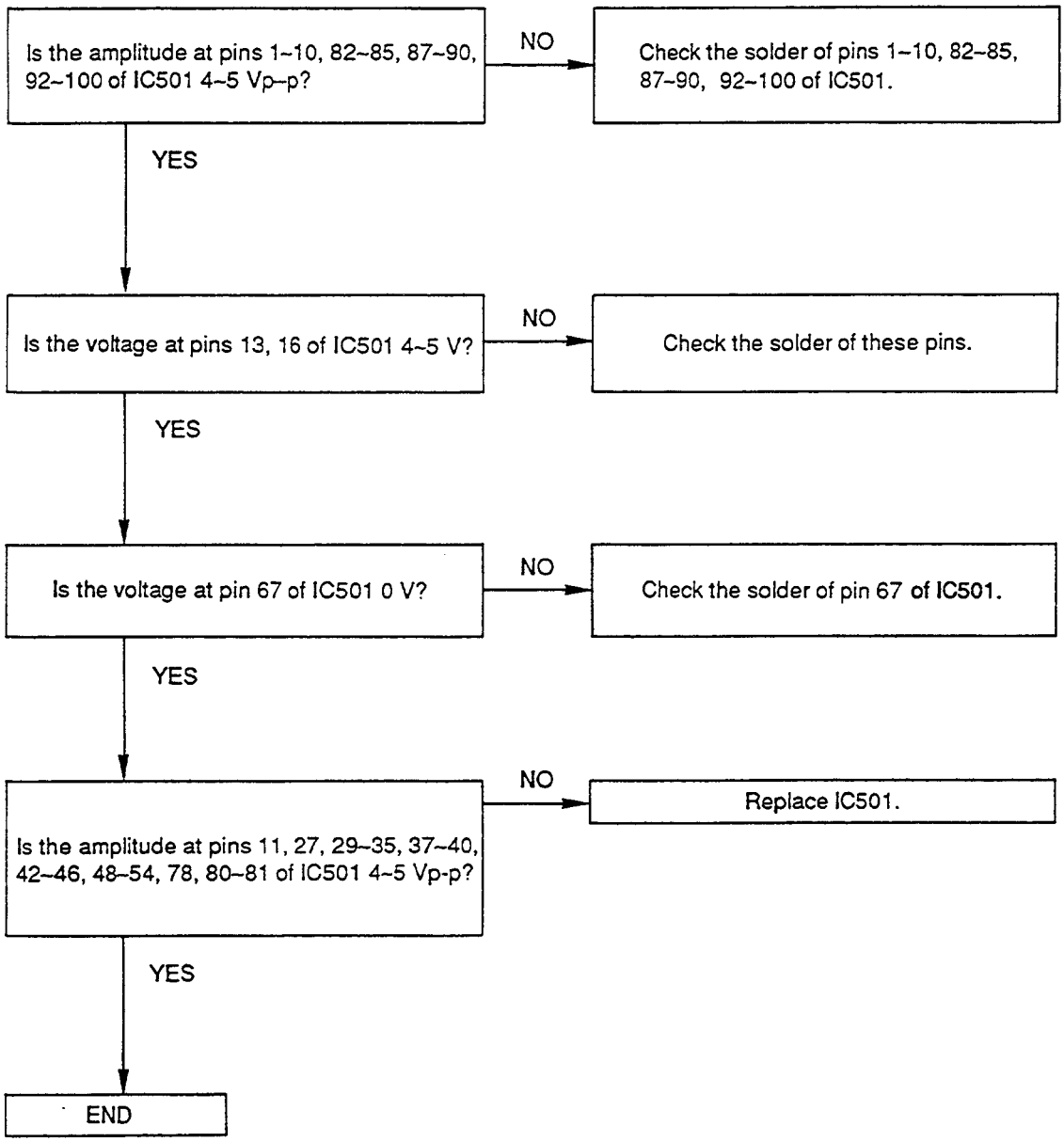
Note 4) Check bus line


Is the amplitude at pins 1~5, 7~10, 12~15, 21~22 and 30~40 of IC101 4~5 Vp-p?
NO
Check the short pins of IC101, IC102, IC103, IC104, IC301, IC302, IC501(Digital board) and IC15 (Analog board). Or replace some of these ICs.
YES
END

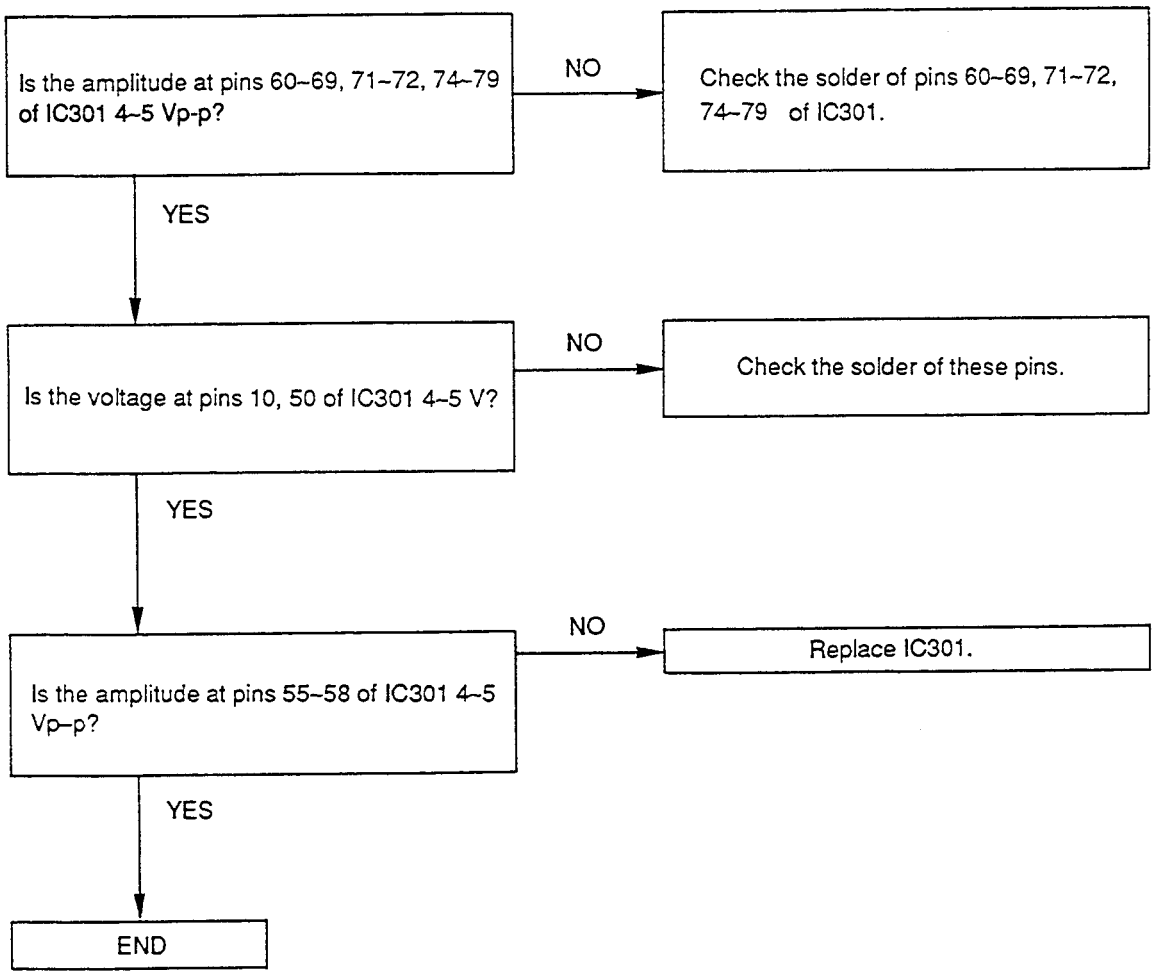
Note 5) Check key scan and input



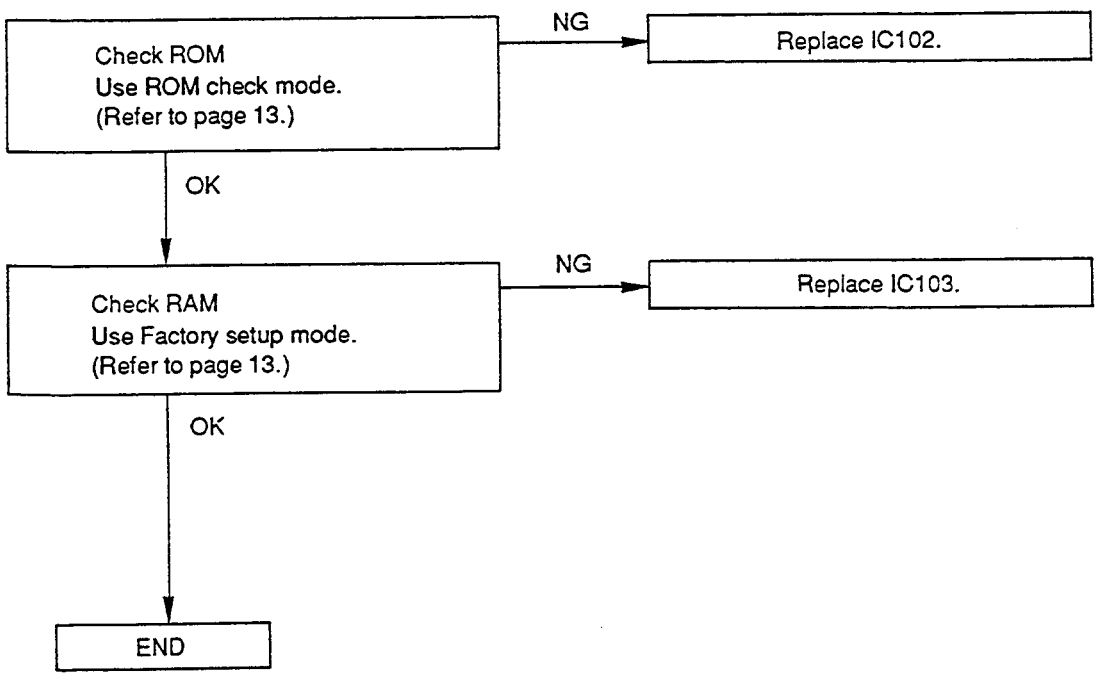
Note 5) Check IC501


Is the amplitude at pins 1~10, 82~85, 87~90, 92~100 of IC501 4~5 Vp-p?
NO
Check the solder of pins 1~10, 82~85, 87~90, 92~100 of IC501.
YES
Is the voltage at pins 13, 16 of IC501 4~5 V?
NO
Check the solder of these pins.
YES
Is the voltage at pin 67 of IC501 0 V?
NO
Check the solder of pin 67 of IC501.
YES
Is the amplitude at pins 11, 27, 29~35, 37~40, 42~46, 48~54, 78, 80~81 of IC501 4~5 Vp-p?
NO
Replace IC501.
YES
END

Note 6) Check IC301.

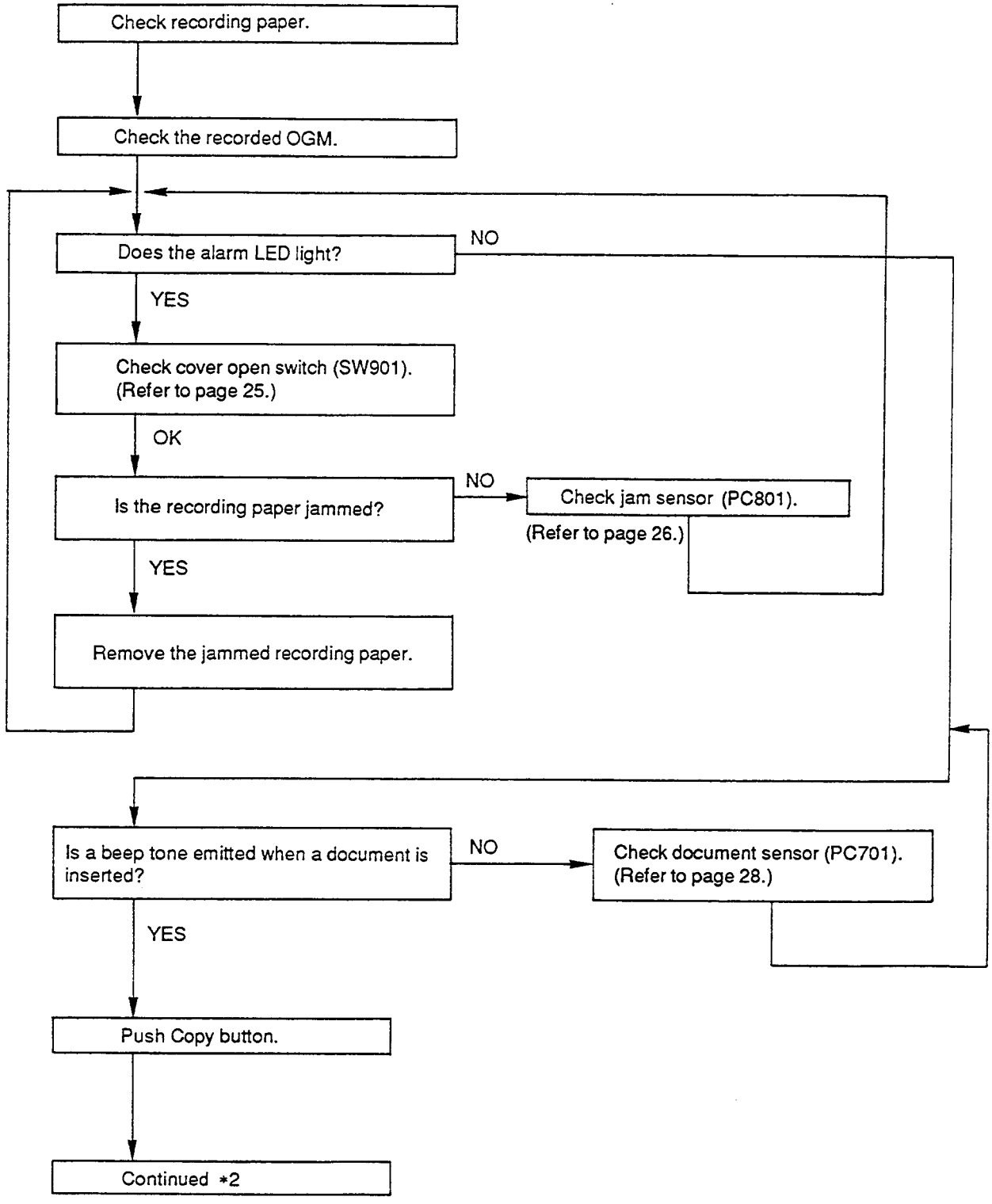

Is the amplitude at pins 60~69, 71~72, 74~79 of IC301 4~5 Vp-p?
NO
Check the solder of pins 60~69, 71~72, 74~79 of IC301.
YES
Is the voltage at pins 10, 50 of IC301 4~5 V?
NO
Check the solder of these pins.
YES
Is the amplitude at pins 55~58 of IC301 4~5 Vp-p?
NO
Replace IC301.
YES
END

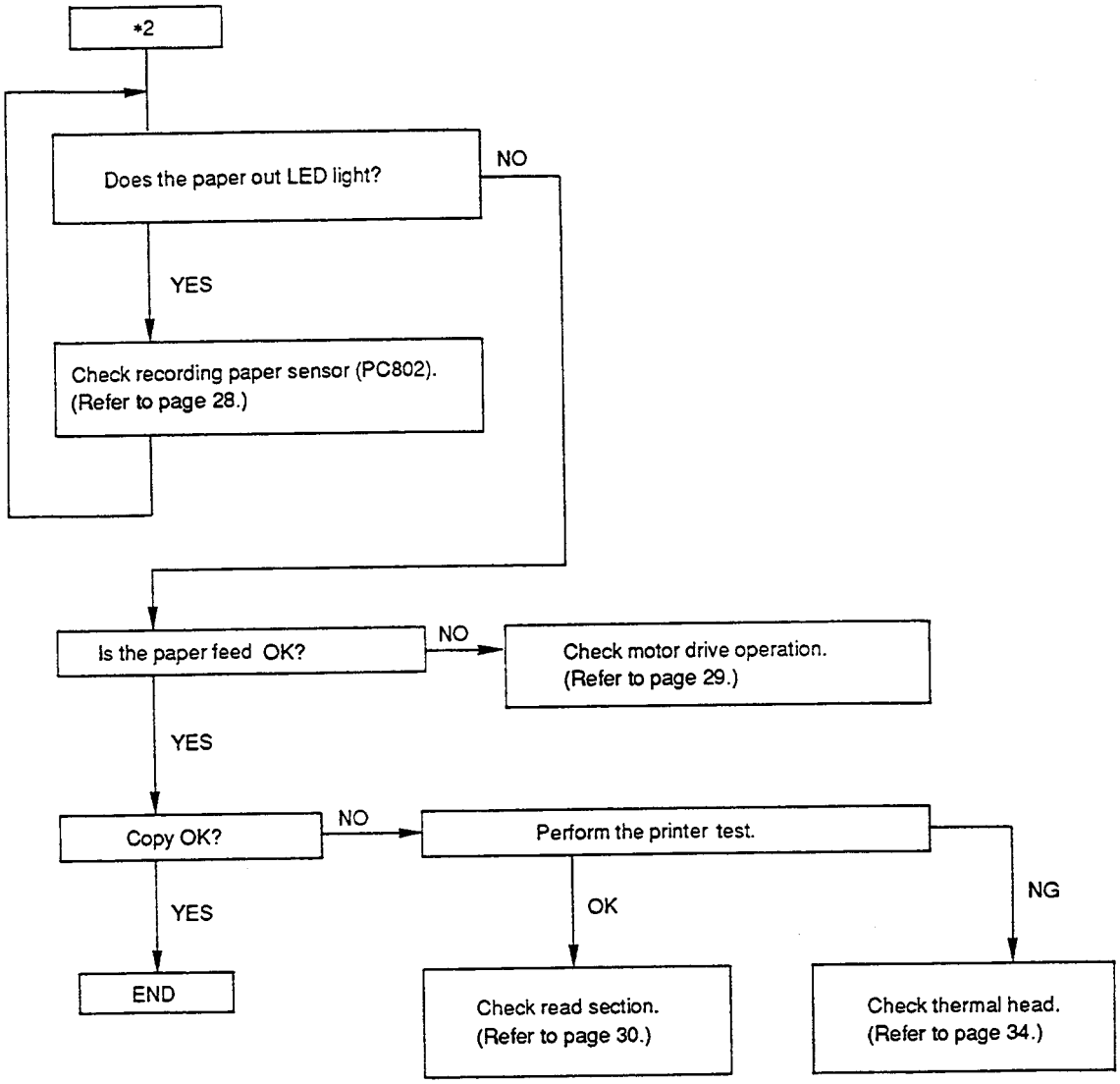
4-2. SOME FUNCTIONS WORK, BUT OTHERS DO NOT.



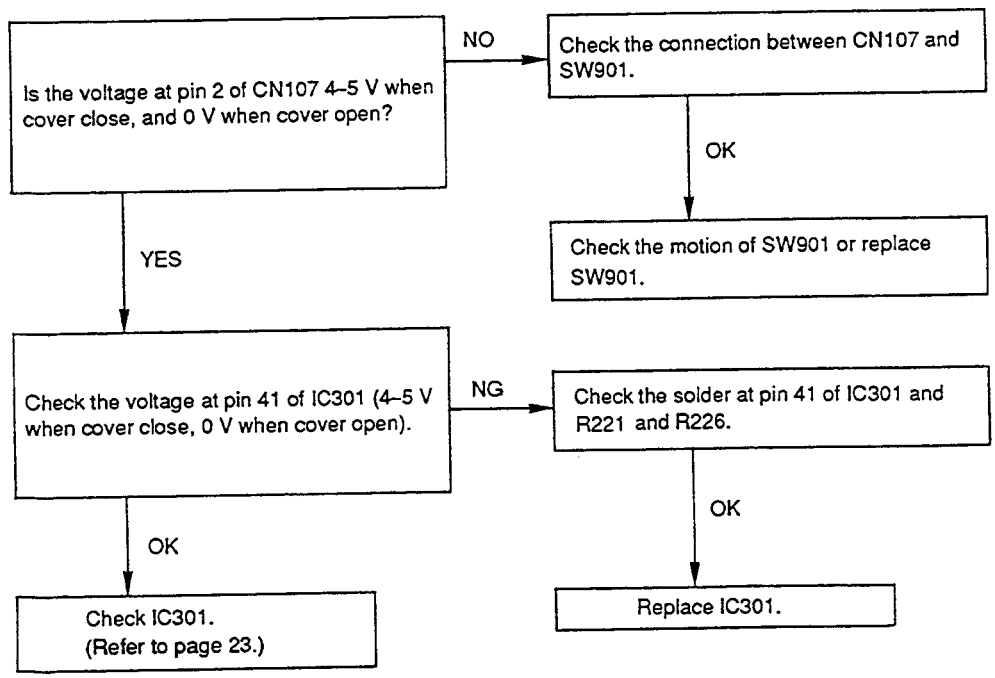
5. DEFECTIVE FACSIMILE SECTION

5-1. DOES NOT COPY OR COPY IMAGE IS INCORRECT AND DOES NOT TRANSMIT OR RECEIVE.

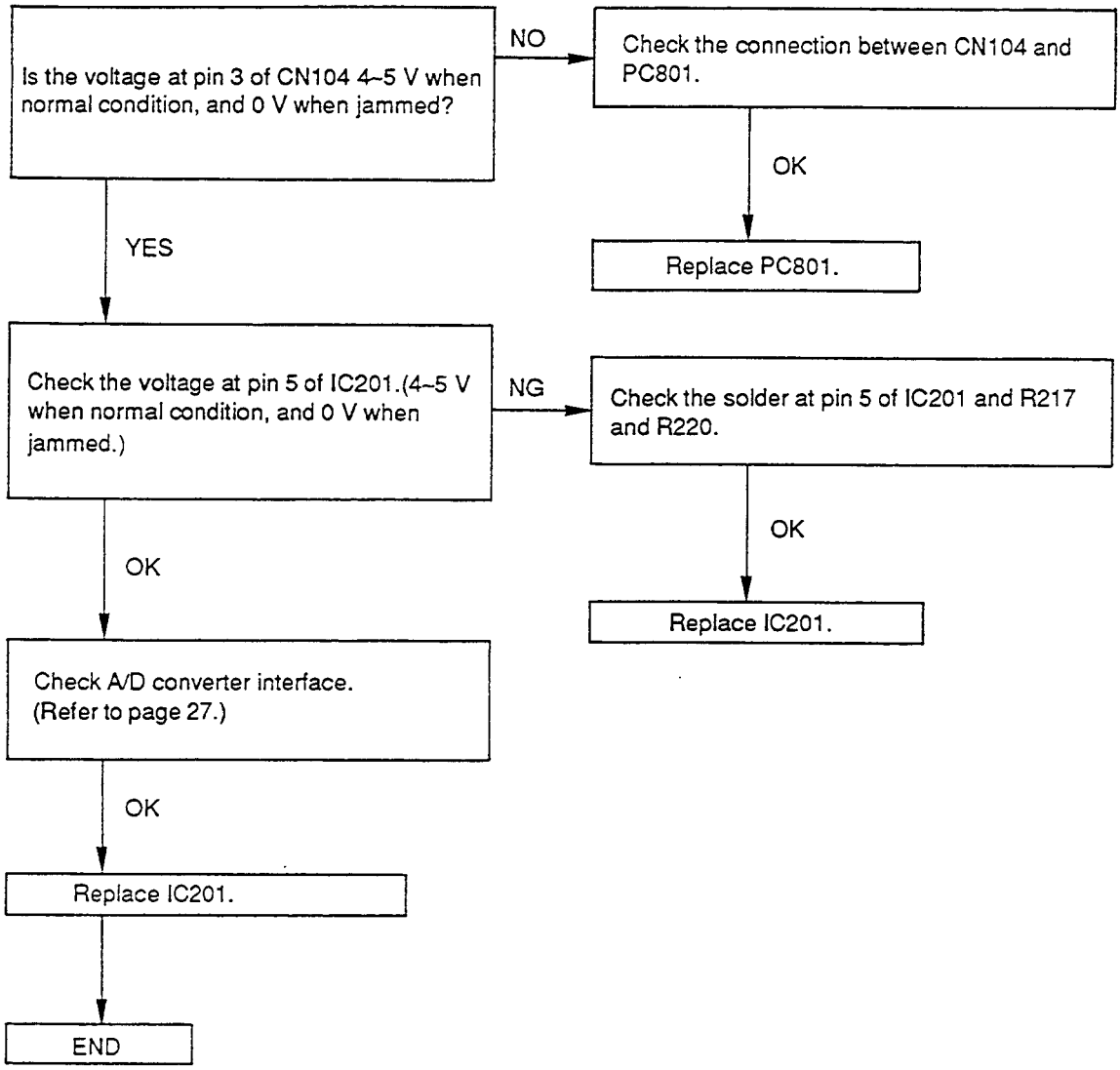




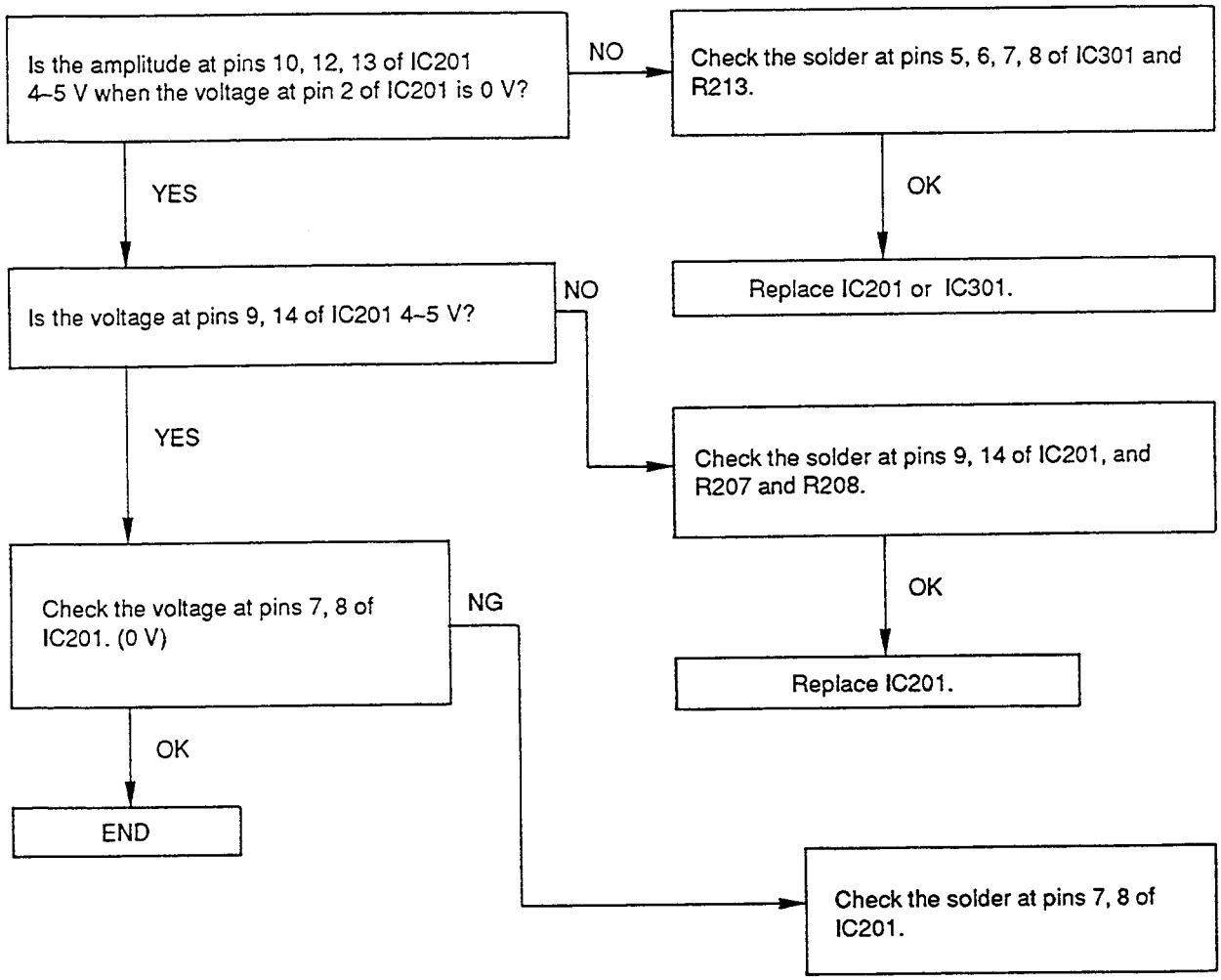
Note 1) Check cover open switch (SW901)


Is the voltage at pin 2 of CN107 4–5 V when cover close, and 0 V when cover open?
NO
Check the connection between CN107 and SW901.
OK
Check the motion of SW901 or replace SW901.
YES
Check the voltage at pin 41 of IC301 (4–5 V when cover close, 0 V when cover open).
NG
Check the solder at pin 41 of IC301 and R221 and R226.
OK
OK
Check IC301.
(Refer to page 23.)
Replace IC301.

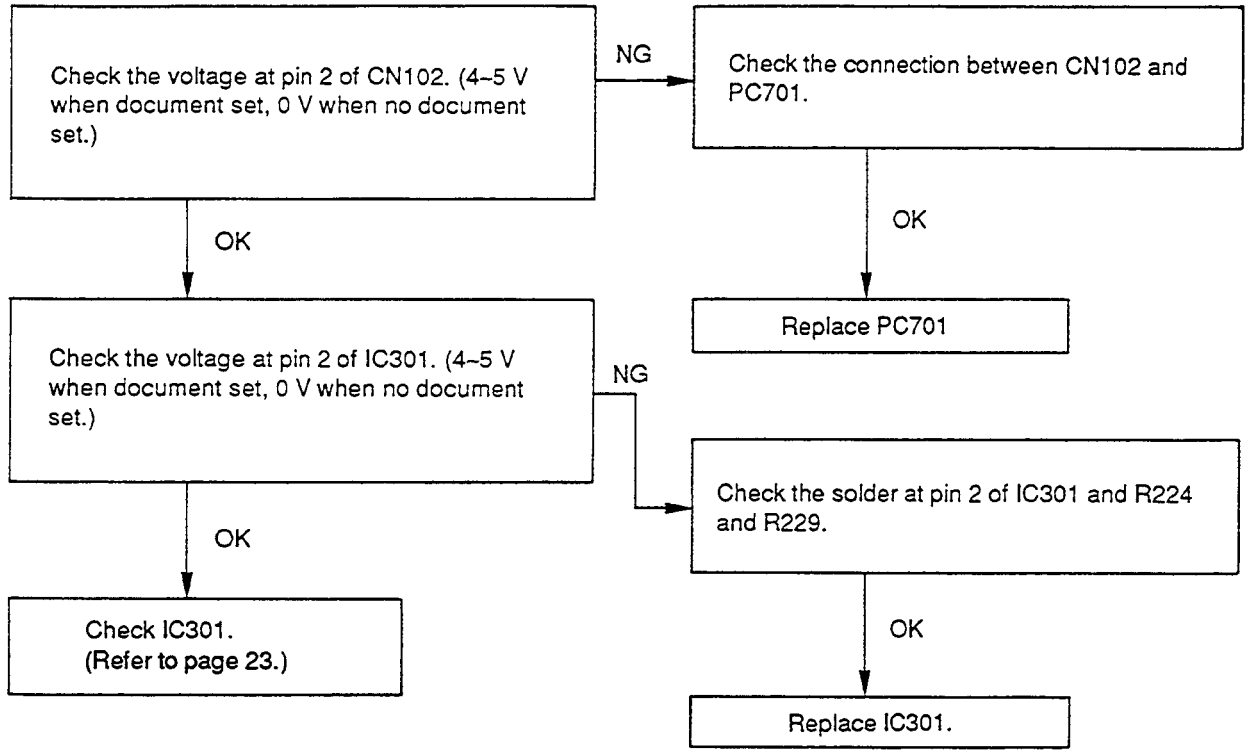
Note 2) Check jam sensor (PC801)


Is the voltage at pin 3 of CN104 4~5 V when normal condition, and 0 V when jammed?
NO
Check the connection between CN104 and PC801.
OK
Replace PC801.
YES
Check the voltage at pin 5 of IC201.(4~5 V when normal condition, and 0 V when jammed.)
NG
Check the solder at pin 5 of IC201 and R217 and R220.
OK
Replace IC201.
OK
Check A/D converter interface. (Refer to page 27.)
OK
Replace IC201.
END

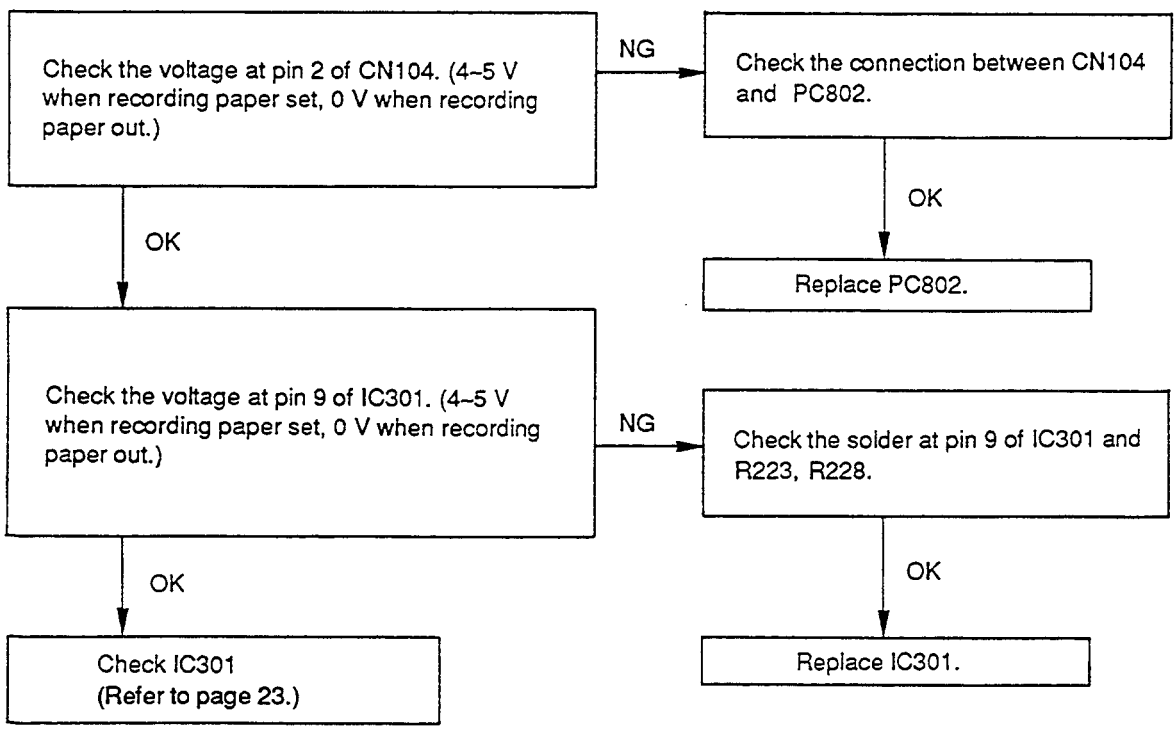
Note 3) Check A/D converter interface


Is the amplitude at pins 10, 12, 13 of IC201 4~5 V when the voltage at pin 2 of IC201 is 0 V?
NO
Check the solder at pins 5, 6, 7, 8 of IC301 and R213.
YES
OK
Is the voltage at pins 9, 14 of IC201 4~5 V?
NO
Replace IC201 or IC301.
YES
Check the solder at pins 9, 14 of IC201, and R207 and R208.
Check the voltage at pins 7, 8 of IC201. (0 V)
NG
OK
Replace IC201.
OK
END
Check the solder at pins 7, 8 of IC201.

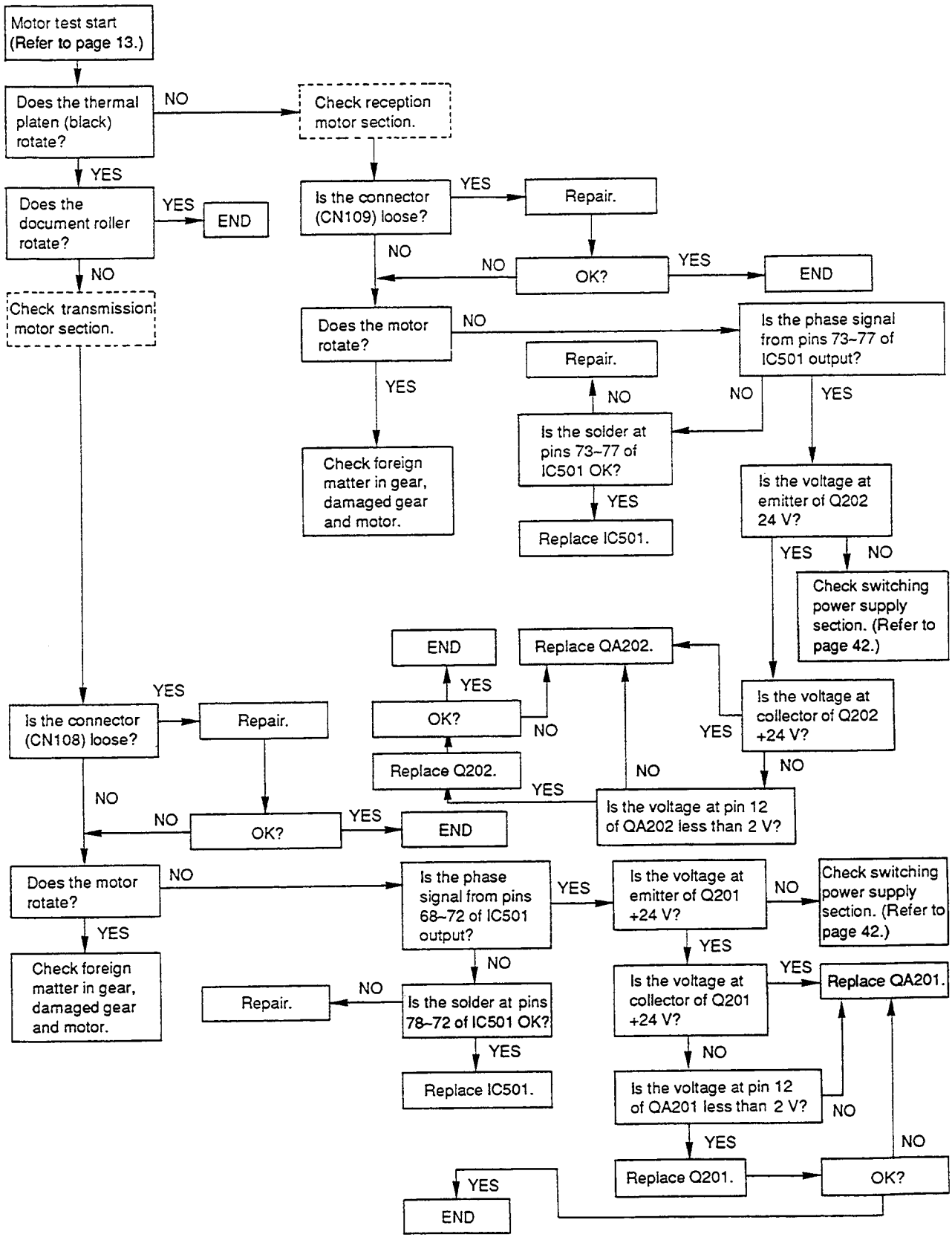
Note 4) Check document sensor (PC701)


Check the voltage at pin 2 of CN102. (4~5 V when document set, 0 V when no document set.)
NG
Check the connection between CN102 and PC701.
OK
OK
Replace PC701
Check the voltage at pin 2 of IC301. (4~5 V when document set, 0 V when no document set.)
NG
Check the solder at pin 2 of IC301 and R224 and R229.
OK
OK
Check IC301.
(Refer to page 23.)
Replace IC301.

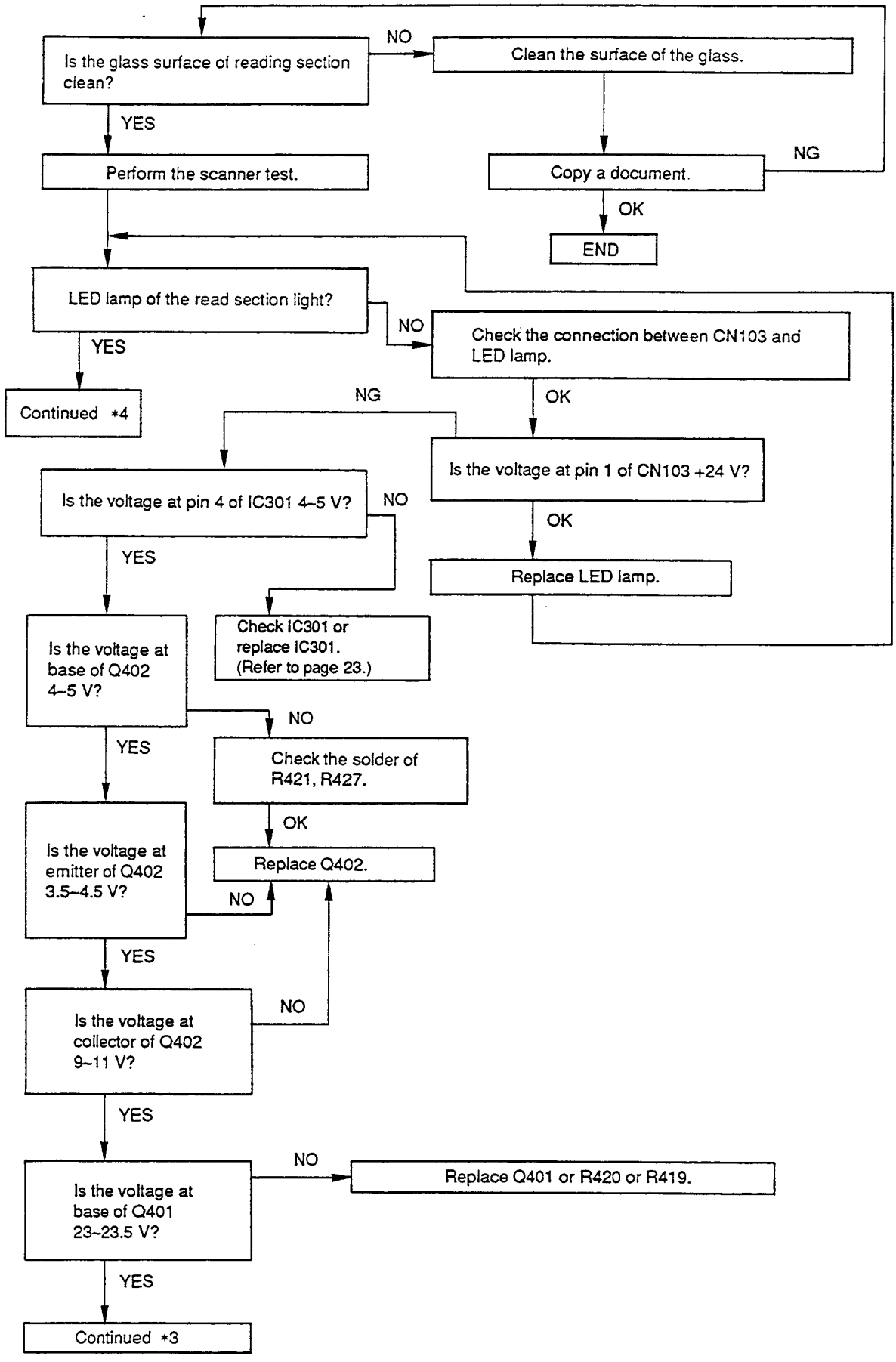
Note 5) Check recording paper sensor (PC802)

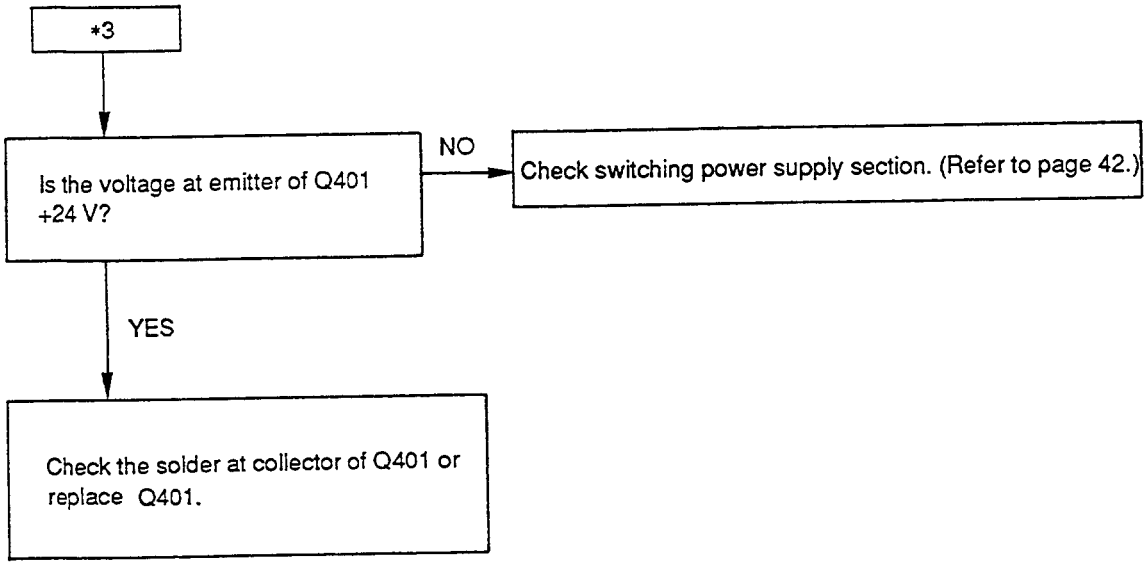

Check the voltage at pin 2 of CN104. (4~5 V when recording paper set, 0 V when recording paper out.)
NG
Check the connection between CN104 and PC802.
OK
OK
Replace PC802.
Check the voltage at pin 9 of IC301. (4~5 V when recording paper set, 0 V when recording paper out.)
NG
Check the solder at pin 9 of IC301 and R223, R228.
OK
OK
Check IC301
(Refer to page 23.)
Replace IC301.

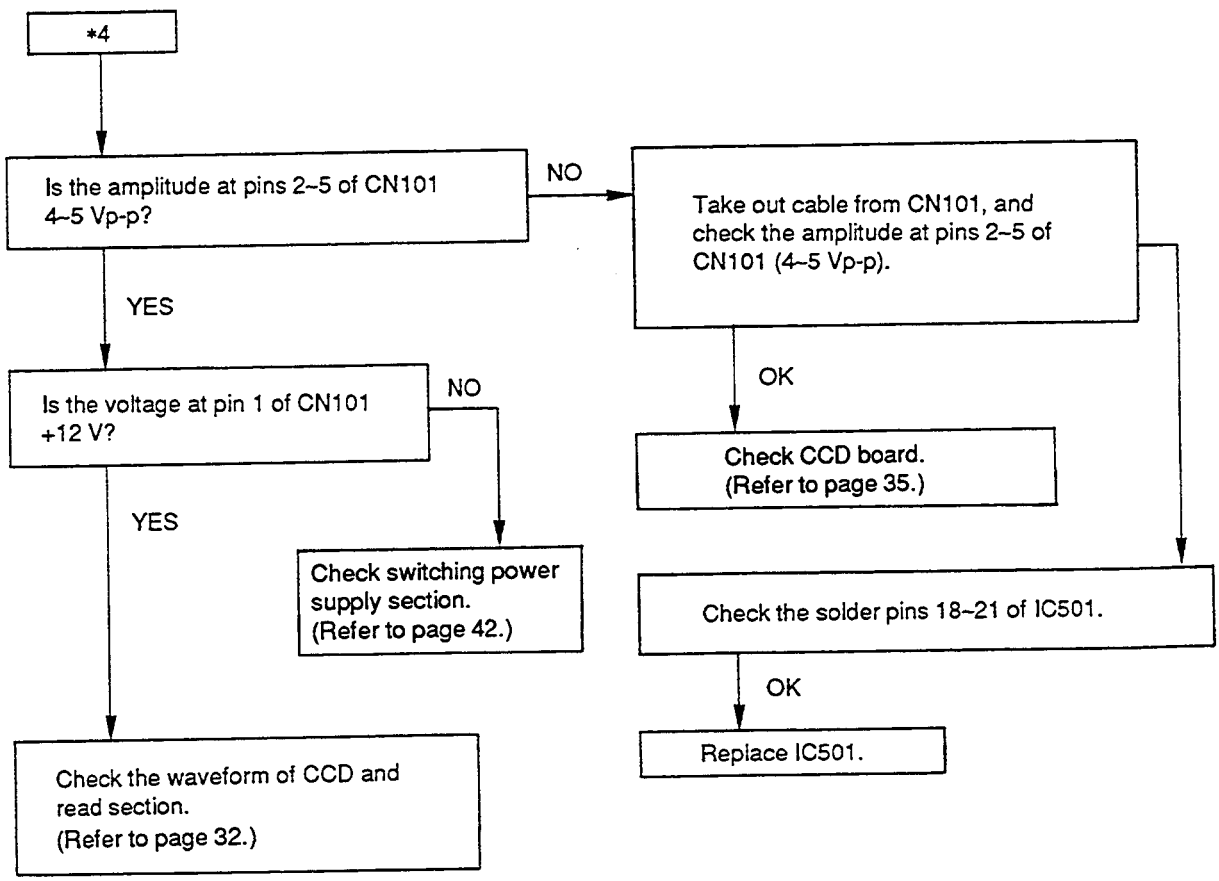
Note 6) Check motor drive operation.



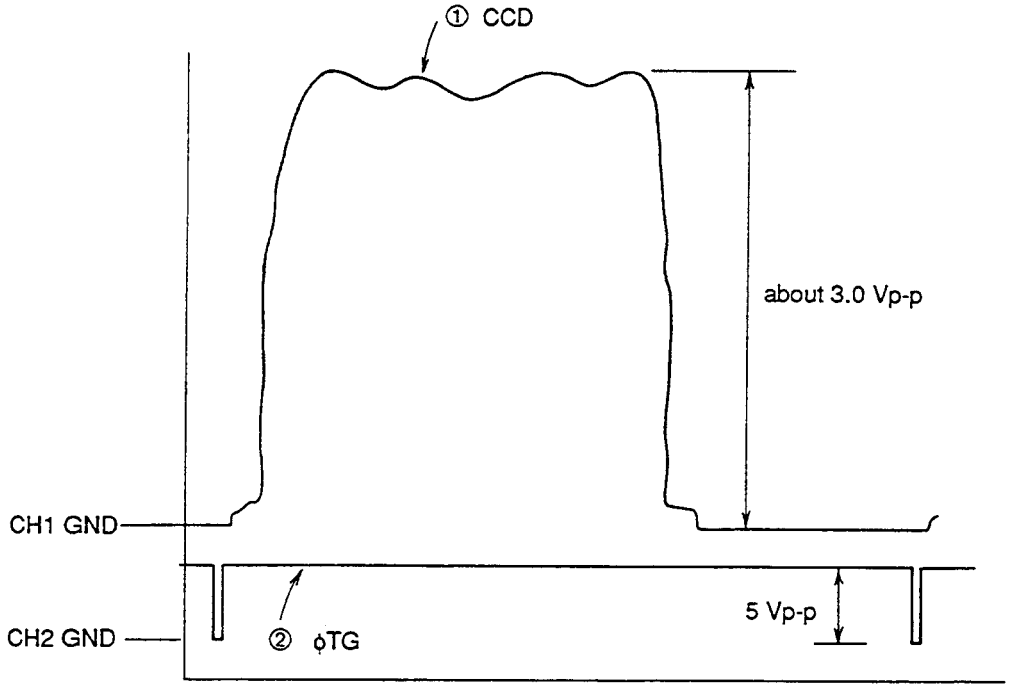
Note 7) Check read section




*3
Is the voltage at emitter of Q401 +24 V?
NO
Check switching power supply section. (Refer to page 42.)
YES
Check the solder at collector of Q401 or replace Q401.


*4
Is the amplitude at pins 2~5 of CN101 4~5 Vp-p?
NO
Take out cable from CN101, and check the amplitude at pins 2~5 of CN101 (4~5 Vp-p).
YES
OK
Check CCD board. (Refer to page 35.)
Is the voltage at pin 1 of CN101 +12 V?
NO
YES
Check switching power supply section. (Refer to page 42.)
Check the solder pins 18~21 of IC501.
OK
Check the waveform of CCD and read section. (Refer to page 32.)
Replace IC501.

Waveform of read section



Oscilloscope setting

V: CH1 0.5 V/div
CH2 5 V/div
DC couple, CHOP mode

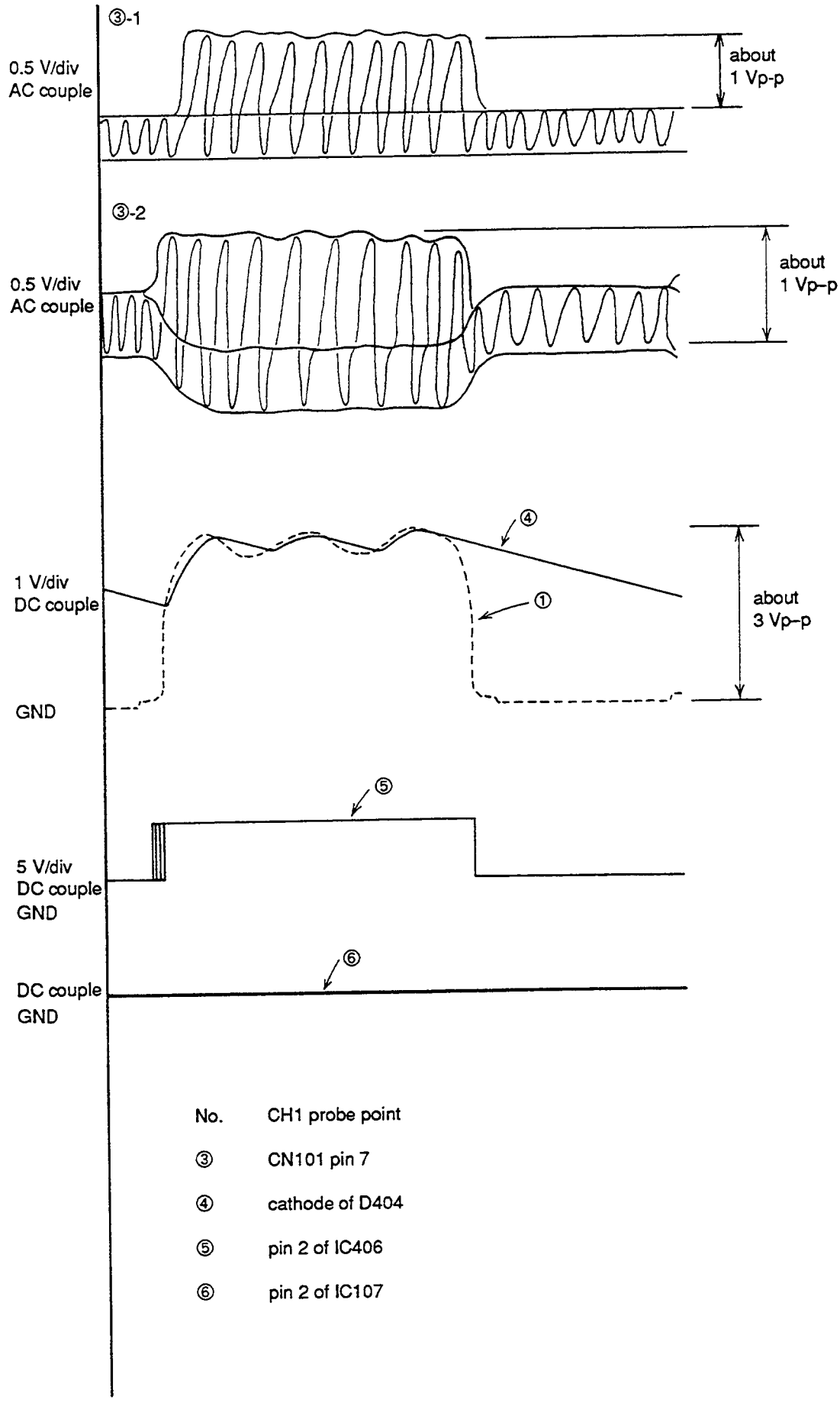
H: 1 msec / div

Trigger: CH2 SLOPE (–)

Probe point: CH1 Test point "CCD" (cathode of D401)
CH2 Test point "φTG" signal (pin 19 of IC501)

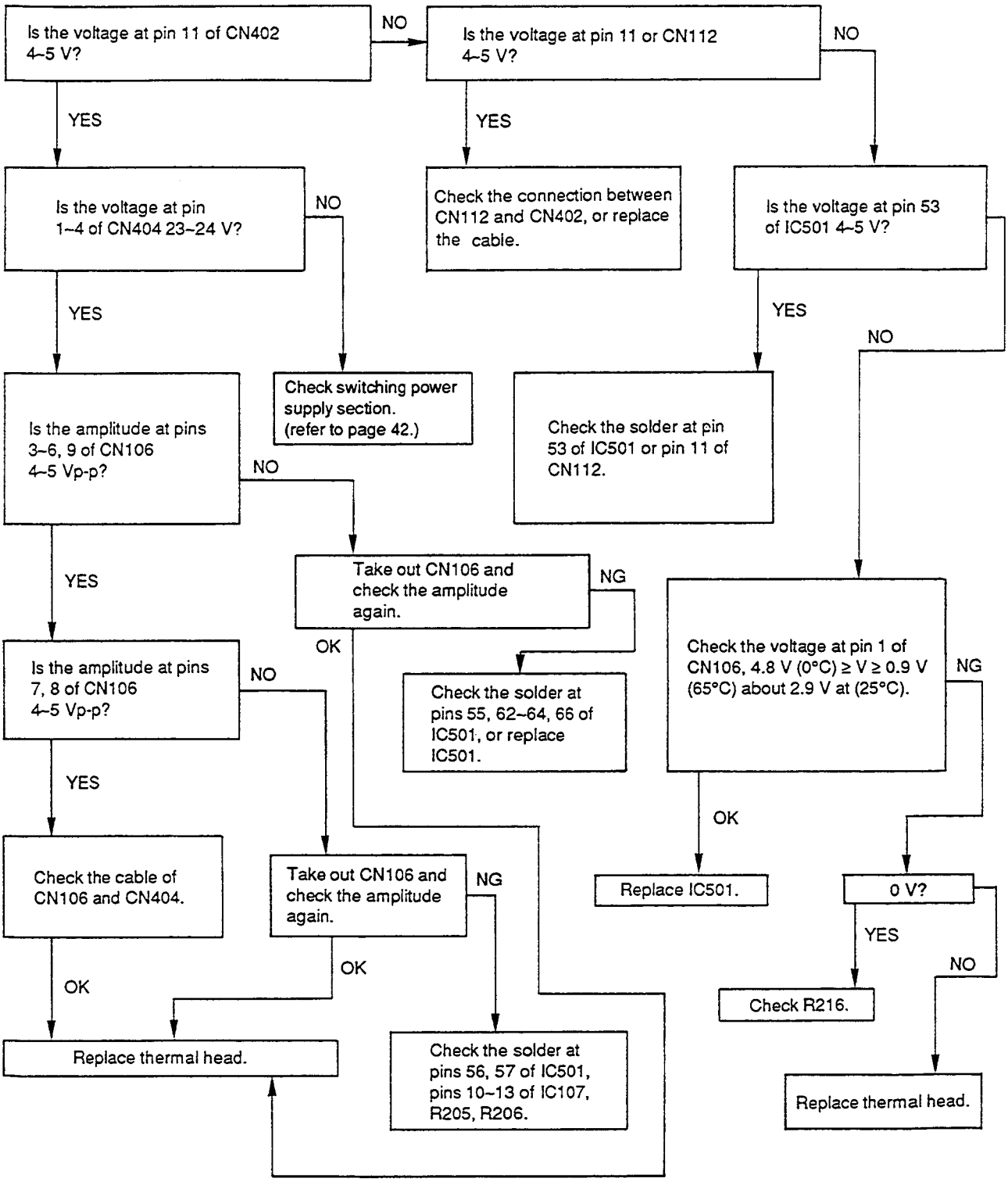
Waveform: ① CH1 CCD signal
② CH2 φTG signal (trigger)

Note: This waveform will be shown when the CCD read the white plate of document cover.

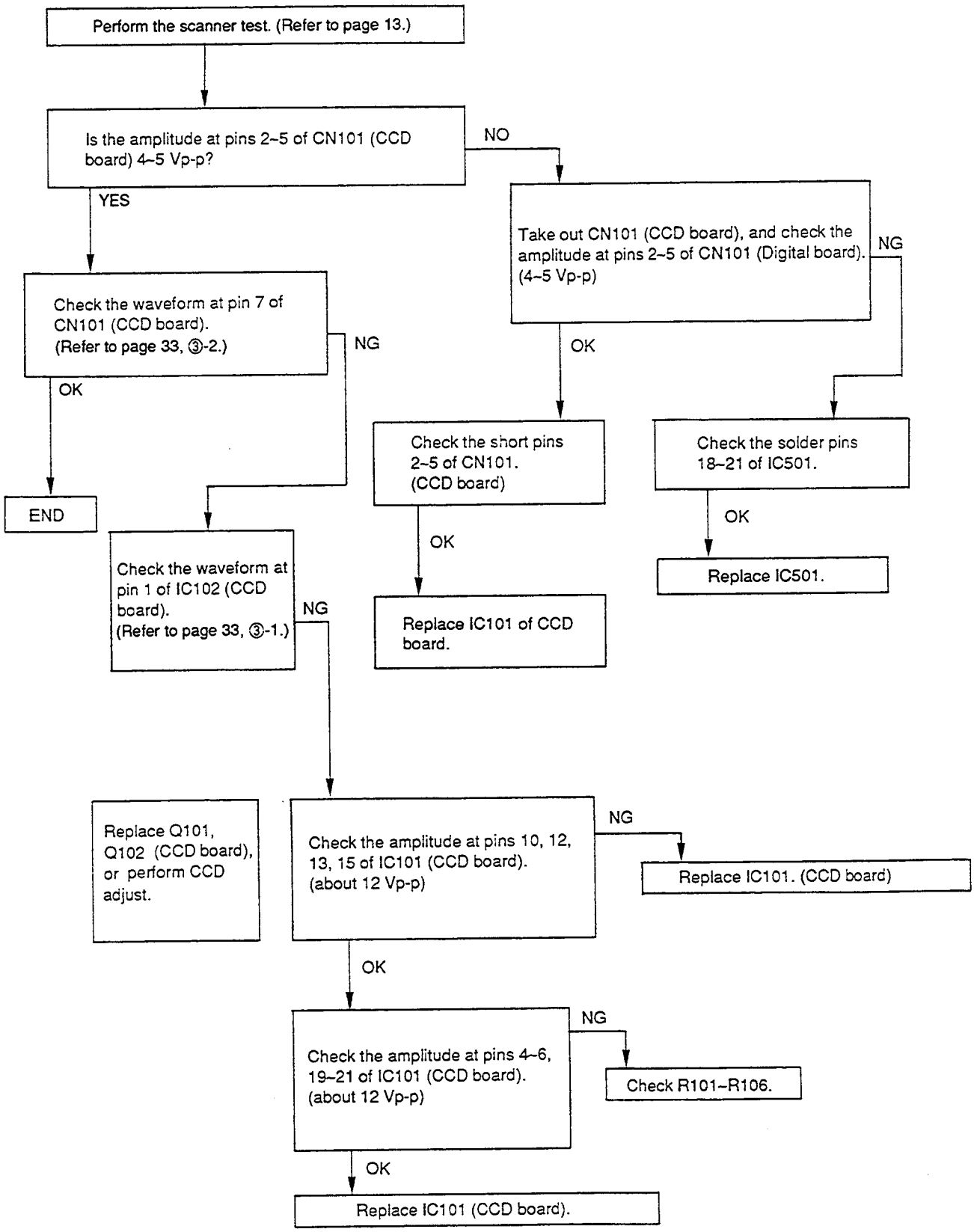


No.	CH1 probe point
③	CN101 pin 7
④	cathode of D404
⑤	pin 2 of IC406
⑥	pin 2 of IC107

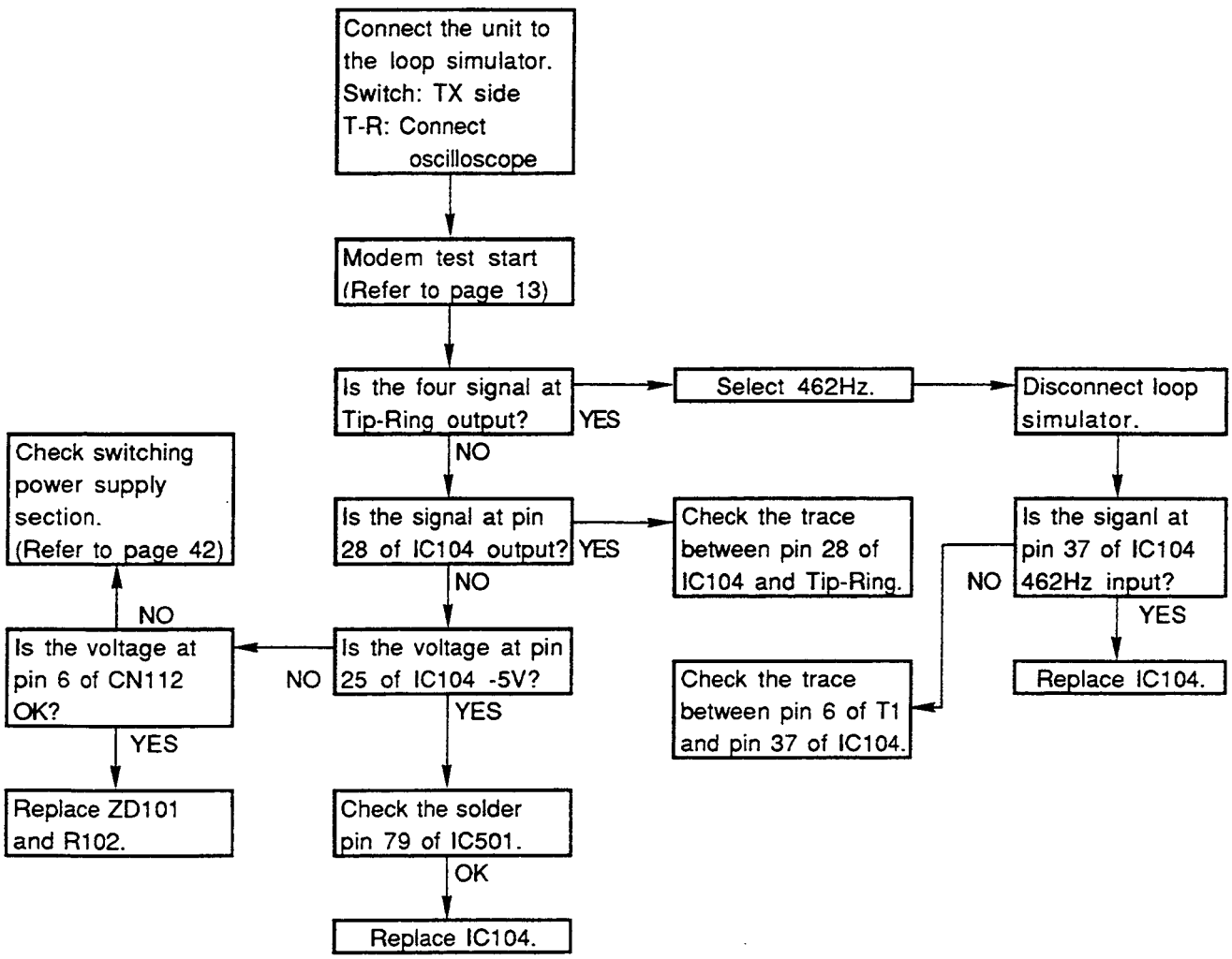
Note 8) Check the thermal head


Is the voltage at pin 11 of CN402 4–5 V?
NO
Is the voltage at pin 11 or CN112 4–5 V?
NO
YES
YES
Is the voltage at pin 1–4 of CN404 23–24 V?
NO
Check the connection between CN112 and CN402, or replace the cable.
Is the voltage at pin 53 of IC501 4–5 V?
YES
YES
NO
Is the amplitude at pins 3–6, 9 of CN106 4–5 Vp-p?
NO
Check switching power supply section. (refer to page 42.)
Check the solder at pin 53 of IC501 or pin 11 of CN112.
YES
Take out CN106 and check the amplitude again.
NG
OK
Check the voltage at pin 1 of CN106, 4.8 V (0°C) ≥ V ≥ 0.9 V (65°C) about 2.9 V at (25°C).
NG
Is the amplitude at pins 7, 8 of CN106 4–5 Vp-p?
NO
Check the solder at pins 55, 62–64, 66 of IC501, or replace IC501.
YES
OK
Check the cable of CN106 and CN404.
Take out CN106 and check the amplitude again.
NG
Replace IC501.
0 V?
YES
NO
OK
OK
Check R216.
Replace thermal head.
Check the solder at pins 56, 57 of IC501, pins 10–13 of IC107, R205, R206.
Replace thermal head.

Note 9) Check CCD board


Perform the scanner test. (Refer to page 13.)
Is the amplitude at pins 2–5 of CN101 (CCD board) 4–5 Vp-p?
NO
YES
Take out CN101 (CCD board), and check the amplitude at pins 2–5 of CN101 (Digital board). (4–5 Vp-p)
NG
OK
Check the waveform at pin 7 of CN101 (CCD board). (Refer to page 33, ③-2.)
NG
OK
END
Check the short pins 2–5 of CN101. (CCD board)
Check the solder pins 18–21 of IC501.
OK
OK
Replace IC501.
Check the waveform at pin 1 of IC102 (CCD board). (Refer to page 33, ③-1.)
NG
Replace IC101 of CCD board.
Replace Q101, Q102 (CCD board), or perform CCD adjust.
Check the amplitude at pins 10, 12, 13, 15 of IC101 (CCD board). (about 12 Vp-p)
NG
Replace IC101. (CCD board)
OK
Check the amplitude at pins 4–6, 19–21 of IC101 (CCD board). (about 12 Vp-p)
NG
Check R101–R106.
OK
Replace IC101 (CCD board).

5-2. UNIT CAN COPY, BUT CAN NOT TRANSMIT/RECEIVE


Connect the unit to the loop simulator. Switch: TX side T-R: Connect oscilloscope
Modem test start (Refer to page 13)
Is the four signal at Tip-Ring output?
YES
Select 462Hz.
Disconnect loop simulator.
NO
Check switching power supply section. (Refer to page 42)
Is the signal at pin 28 of IC104 output?
YES
Check the trace between pin 28 of IC104 and Tip-Ring.
Is the siganl at pin 37 of IC104 462Hz input?
NO
YES
NO
Is the voltage at pin 6 of CN112 OK?
NO
Is the voltage at pin 25 of IC104 -5V?
Check the trace between pin 6 of T1 and pin 37 of IC104.
Replace IC104.
YES
YES
Replace ZD101 and R102.
Check the solder pin 79 of IC501.
OK
Replace IC104.

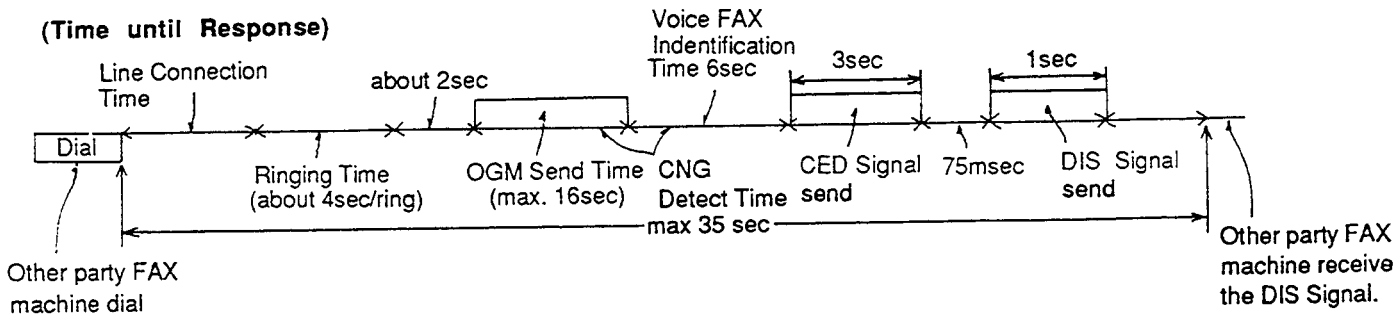
5-3. UNIT CAN COPY, BUT CAN NOT TRANSMIT/RECEIVE LONG DISTANCE OR INTERNATIONAL COMMUNICATION

The following 2 causes can be considered for this.

1) Cause 1

The other party is executing automatic calling, the call has been received by this unit, and the time until response with a CED or DIS signal has been too long. (In almost case, this unit detects CNG signal and can respond to CED or DIS.) (According to the CCITT standard, the communication procedure is stopped when there is no response from the other party within 35sec, so that the other party releases the line.)

(Time until Response)



(Cause and Countermeasure)

As shown in the above chart, the total handshaking time must be reduced, but because of the long distance connection and linking of several stations, the line connection time can not be reduced. Accordingly, the following countermeasures should be tried.

(A) The automatic reception bell number should be1. (user parameter: code No. 32)

(B) The OGM recording time should be made as short as possible. (if possible, 8sec or less)

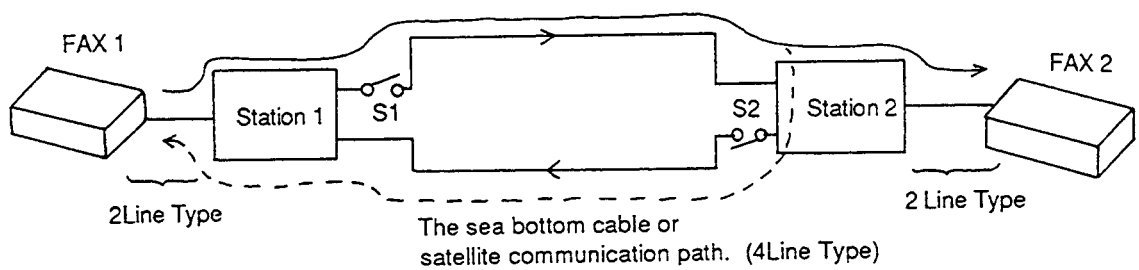
(C) As the count of 35sec is started directly after dialing or directly after the START button has been pushed for models with a START button, the other party should be called manually, if possible, this unit be switched to FAX by [*] button when the OGM is heard, and then the START button should be pushed for FAX communication.
Another possibility is entry of two pauses at the end of the auto dial number of the transmission side, In this way, the start time for the count can be delayed by 2 pauses (about 10sec).

(Note) For short OGM recording, the OGM button must be pushed to end the OGM recording.

2) Cause 2

Erroneous detection because of echo or erroneous detection because of an echo canceler.

(Echo/Echo Canceler)



The signal from FAX1 reaches FAX2 via the stations 1 and 2, but the reflection signal at station 2 also returns via station 1 (echo). As the distance between station 1 and station 2 is long, the echo returns to FAX 1 max. 600msec after transmission, so that there is the possibility that this signal is detected erroneously as the signal from FAX2 and that trouble is caused. In the case of a normal call, there is also the possibility that the echo of the own voice will make the call difficult to understand. For this reason, each station (station 1, station 2) attaches echo cancelers (S1, S2) in case of international lines or long distance lines. For the echo canceler, the level of the transmission signal from FAX 1 is compared with the level of the reception signal from the FAX2, and when transmission signal is larger, S1 is closed, while S2 is opened when it is smaller. In other words, with transmission from FAX1, S1 is closed and S2 is open, so that the echo does not return to FAX1.

(Cause and Countermeasure)
(Cause A)
When the training signal is transmitted from FAX1 during the communication procedure at the time of transmission from FAX1 to FAX2, there is a delay until the echo canceler operates and S1 is closed, so that a part of the head of the training signal may drop out, normal reception by FAX2 may not be possible,and transmission may not be started.
(Countermeasure A)
When the international line mode becomes ON in service mode (code No. 21), a dummy signal is attached to the head of the training signal to prevent this problem. As this normally is ON, it is necessary to reconfirm that this has not becomes OFF. When the international mode is switched OFF, the transmission side will try the training signal three times at each speed (9600BPS, 4800BPS and 2400BPS), and in case of NG, it will drop the speed by one rank (fall-back). When the international mode is switched ON, each speed will be tried only twice. In other words, the slower speed with fewer errors are reached more easily. This is done as the line conditions may deteriorate and the picture may be disturbed more easily during communication in case of international lines or long distance communication, even when the training has been OK.The default value is ON as preference is given to clearer pictures rather than speed.

(Cause B)
The echo canceler operation is stopped with a signal of 2100Hz (i.e. S1 and S2 become ON).
Accordingly, when FAX1 has executed automatic reception, a CED signal is output, and if this signal should be 2100Hz, S1 and S2 will become ON. Then the echo of the DIS signal output afterwards may be received and FAX1 may execute erroneous operation, preventing start of communication.
(Countermeasure B)
In service mode, the CED signal frequency is set to 1100Hz (code No. 20) or the time setting between the CED signal and the DIS signal is set from 75msec to 500msec in service mode (code No. 93). This is done because the echo canceler operation stop mode is cancelled with an interval of 250msec or more.

(Cause C)
A KX-F50 shall be assumed for FAX1 and a set of a different company from shall be assumed for FAX2.
In case of transmission from the KX-F50 to FAX2, FAX2 executes automatic reception and transmits a CED signal (2100Hz), followed by a DIS signal. As here the echo cancelers stops as described in cause B, the echo of the DIS signal returns to FAX2. On the other hand, the KX-F50 detects the DIS signal and transmits a DCS signal. In other words, it is possible that the echo of the DIS signal and the DCS signal transmitted from the KX-F50 reach FAX2 one after the other, FAX2 executes erroneous detection, and communication are not started.
(Countermeasure C)
When international DIS detection setting is made effective in service mode (code No. 94), the KX-F50 does not respond to the first DIS signal and returns a DCS signal only for the second DIS signal.
In other words, there is an interval of 250msec between transmission of the first and the second DIS signal, so that the echo cancelers operation recovers and no echo is generated for the second DIS signal.
Note:
When the other FAX does not respond with a DCS signal after DIS signal transmission, the DIS signal it transmitted three times for trial.

3) Summary
Long distance and international communication operation.

SYMPTOM	COUNTERMEASURE
Does not reception in automatic mode.	1. The automatic reception ring count should be made 1. (user parameter: code No. 32) 2. The OGM recording time should be made as short as possible. (if possible, 8sec or less) 3. If possible, manual transmission should be made from the transmission side. 4. If possible, two pauses should be inserted at the end of the auto dial number of the transmission side. 5. If possible, the Function Selector Switch should be switched from AUTO/FAX to FAX.
Does not transmission.	1. Confirm the international line mode ON. (service mode: code No. 21) 2. International DIS detection setting is made effective. (service mode: code No. 94)
Does not reception.	1. The time setting between the CED signal and the DIS signal is set to 500msec. (service mode: code No. 93) 2. The CED frequency is set to 1100Hz. (service mode: code No. 20)

5-4. UNIT CAN COPY, BUT THE TRANSMISSION AND RECEPTION IMAGE IS INCORRECT. (LONG DISTANCE AND INTERNATIONAL COMMUNICATION OPERATION.)

This depends widely on the transmission and reception capability of the other FAX set and the line conditions.
The countermeasures for this set are shown below.

1) Transmission Operation
(1) The transmitting speed is set to 4800BPS. (user parameter: code No. 17)
(Individual correspondence according to the other set is desirable.)
(2) The transmitting equalizer is set to 3.6km. (service mode: code No. 24)
(Individual correspondence according to the other set is desirable.)

2) Reception Operation
(1) If 80% or more of the reception should be incorrect, set the receiving speed to 4800BPS. (user parameter: code No. 18)
(2) If 80% or more of the reception should be incorrect, set the receiving equalizer to 3.6km. (service mode: code No. 23)

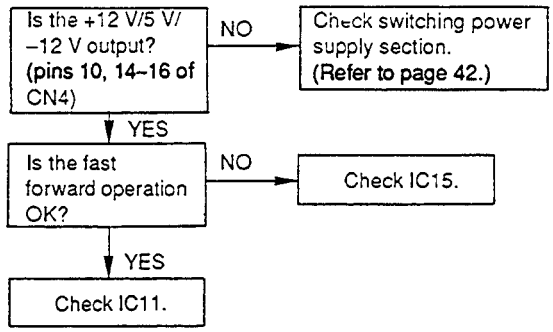
5-5. TRANSMISSION IS NOT POSSIBLE ONLY AT THE TIME OF ONE-TOUCH TRANSMISSION.

1) Case
This is the case because the CNG signal may cause erroneous operation with models of other manufacturers.
(The CNG signal is transmitted after dialing only at the time of one-touch transmission.)

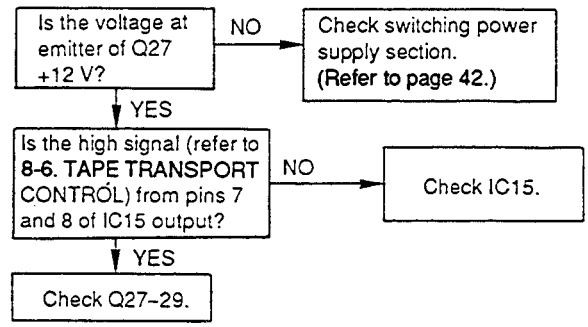
2) Countermeasure
Set CNG output=OFF in service mode (code No. 92), so that the CNG signal will not be output.

6. DEFECTIVE ATAS (Automatic Telephone Answering System) SECTION

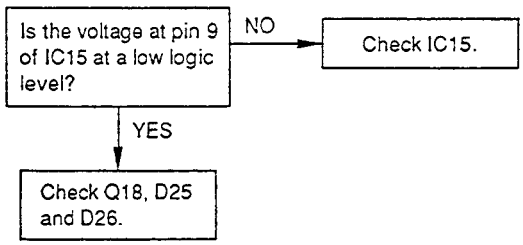
6-1. DOES NOT ATAS OPERATE


Is the +12 V/5 V/ −12 V output? (pins 10, 14–16 of CN4)
NO
Check switching power supply section. (Refer to page 42.)
YES
Is the fast forward operation OK?
NO
Check IC15.
YES
Check IC11.

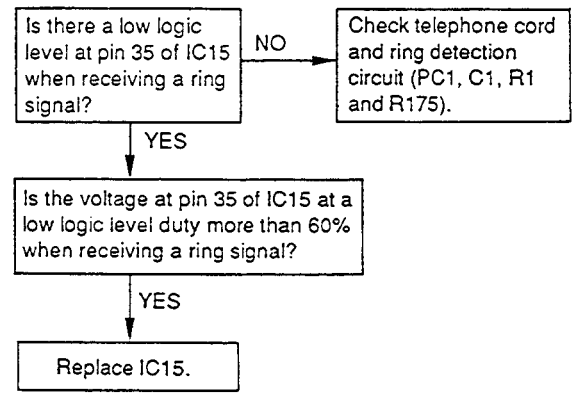
6-2. DOES NOT PULL THE PLUNGER


Is the voltage at emitter of Q27 +12 V?
NO
Check switching power supply section. (Refer to page 42.)
YES
Is the high signal (refer to 8-6. TAPE TRANSPORT CONTROL) from pins 7 and 8 of IC15 output?
NO
Check IC15.
YES
Check Q27–29.

6-3. DOES NOT QUICK ERASE



6-4. DOES NOT AUTOMATIC RECEIVE


Is there a low logic level at pin 35 of IC15 when receiving a ring signal?
NO
Check telephone cord and ring detection circuit (PC1, C1, R1 and R175).
YES
Is the voltage at pin 35 of IC15 at a low logic level duty more than 60% when receiving a ring signal?
YES
Replace IC15.

6-5. ICM CONTINUES TO RECORD AFTER THE CALLER ON-HOOK

When the calleron-hook, this unit can detect the following 4 signal types.
A. CPC pulse.
B. Dial tone or other continuous tones.
C. Silence.
D. Cyclic signals.

A. Check CPC DETECTION CIRCUIT (Refer to page 97.)
B., C., D.
Check VOX DETECTION CIRCUIT (Refer to page 103.)

6-6. REMOTE CONTROL DOES NOT WORK/RESPONSE IS POOR.

The following are considered for the cause of no remote reception:
A. Is the ID code the same as set on the unit.
B. The send signal interferes with the remote signal, causing the remote signal at the line output circuit to be distorted.
C. Excessive loss in telephone line.

A. Check the ID code of the unit.
B. Check NCU section. (Refer to page 96.)
C. Test on telephone line known to be working properly.

•If all of the above check N.G., check the remote signal detection circuit. (Refer to page 108.)

6-7. DOES NOT OGM RECORD/PLAYBACK

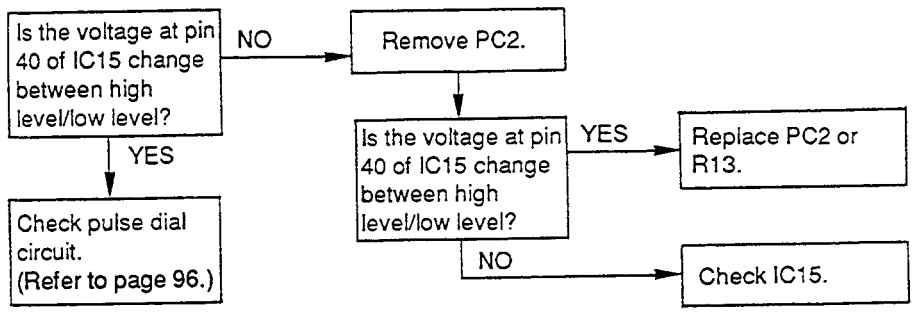
Check IC5, IC6, IC7 and X1. (Refer to page 106.)

7. DEFECTIVE ITS (Integrated Telephone System) SECTION

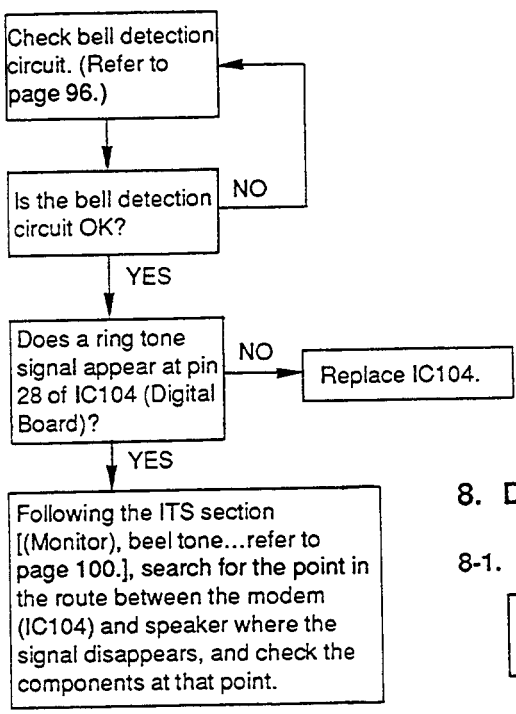
7-1. NO SPEAKERPHONE TRANSMISSION

Following the ITS section (Refer to page 100.) or NCU section (Refer to page 96.), search for the point in the route between the handset microphone and the telephone line (sending) or between the telephone line and the speaker (receiving) where the signal disappears, and check the components at that point.

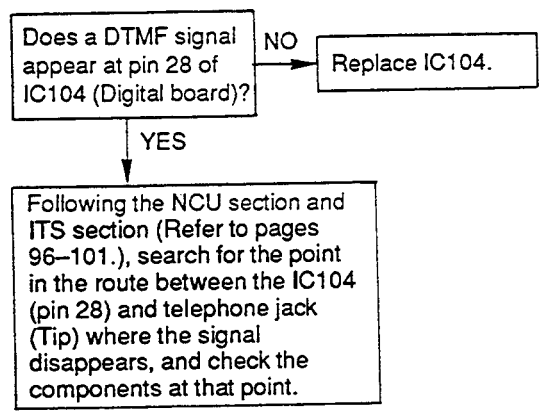
7-2. DOES NOT PULSE DIAL


Is the voltage at pin 40 of IC15 change between high level/low level?
NO
Remove PC2.
YES
Check pulse dial circuit. (Refer to page 96.)
Is the voltage at pin 40 of IC15 change between high level/low level?
YES
Replace PC2 or R13.
NO
Check IC15.

7-3. NO RING TONE

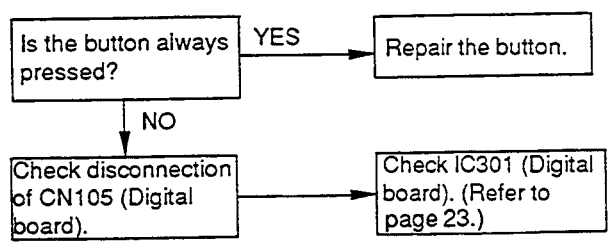

Check bell detection circuit. (Refer to page 96.)
Is the bell detection circuit OK?
NO
YES
Does a ring tone signal appear at pin 28 of IC104 (Digital Board)?
NO
Replace IC104.
YES
Following the ITS section [(Monitor), beel tone...refer to page 100.], search for the point in the route between the modem (IC104) and speaker where the signal disappears, and check the components at that point.

7-4. NO TONE DIALING


Does a DTMF signal appear at pin 28 of IC104 (Digital board)?
NO
Replace IC104.
YES
Following the NCU section and ITS section (Refer to pages 96–101.), search for the point in the route between the IC104 (pin 28) and telephone jack (Tip) where the signal disappears, and check the components at that point.

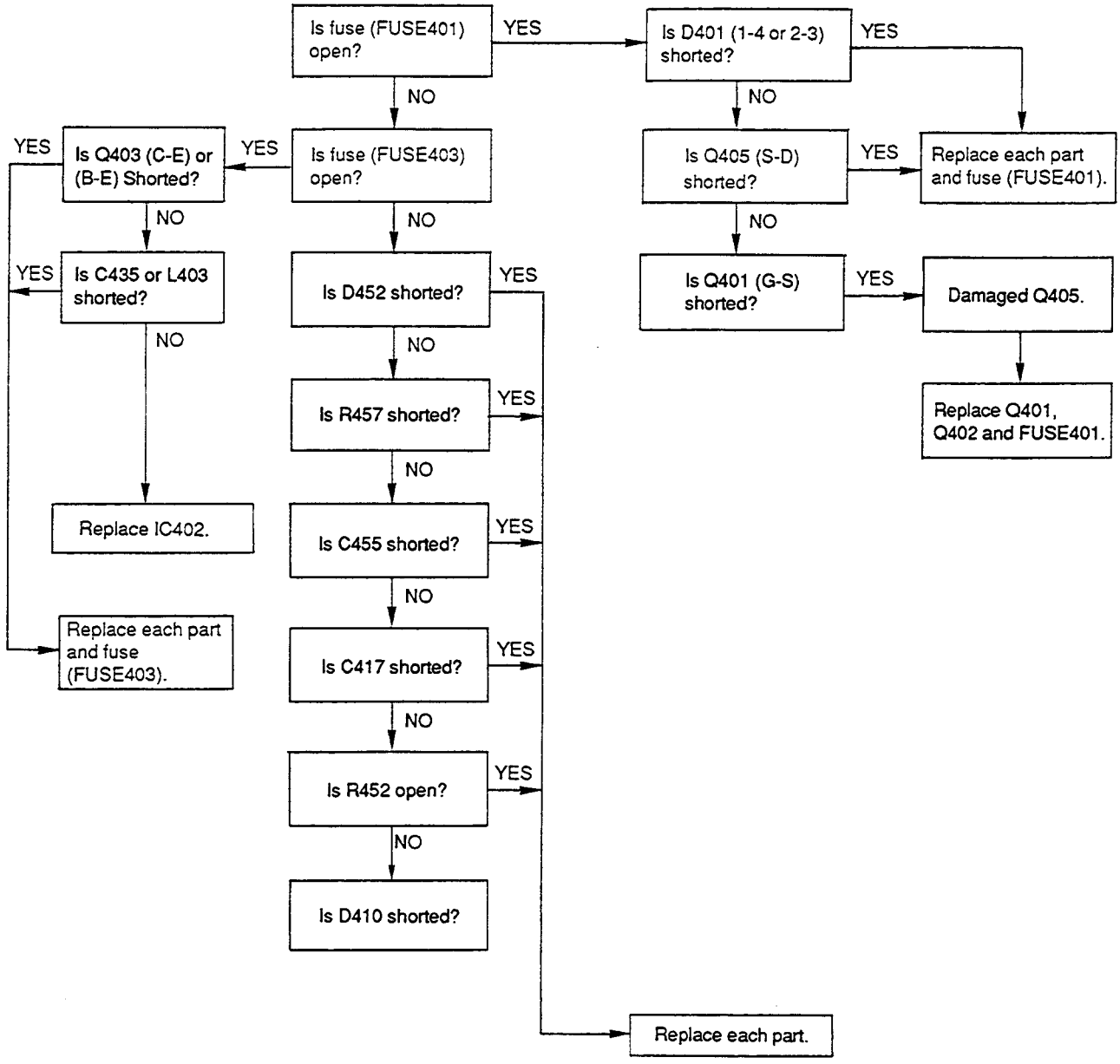
8. DEFECTIVE OPERATION GRILLE SECTION

8-1. NO KEY OPERATION

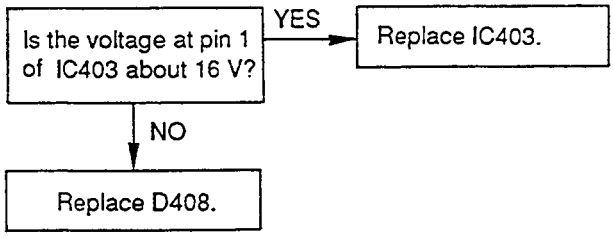

Is the button always pressed?
YES
Repair the button.
NO
Check disconnection of CN105 (Digital board).
Check IC301 (Digital board). (Refer to page 23.)

9. DEFECTIVE SWITCHING POWER SUPPLY SECTION

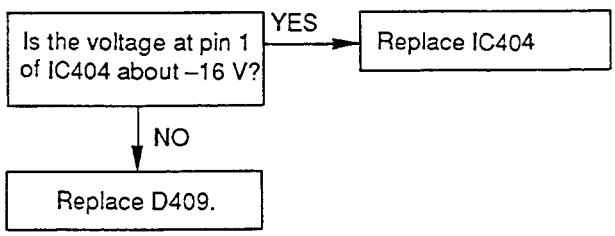
9-1. NO OPERATION



9-2. THE CORRECT VOLTAGES ARE OUTPUT FROM THE 5 V AND 24 V SYSTEMS BUT +12 V IS NOT OUTPUT.



9-3. THE CORRECT VOLTAGES ARE OUTPUT FROM THE 5 V AND 24 V SYSTEMS BUT –12 V IS NOT OUTPUT.

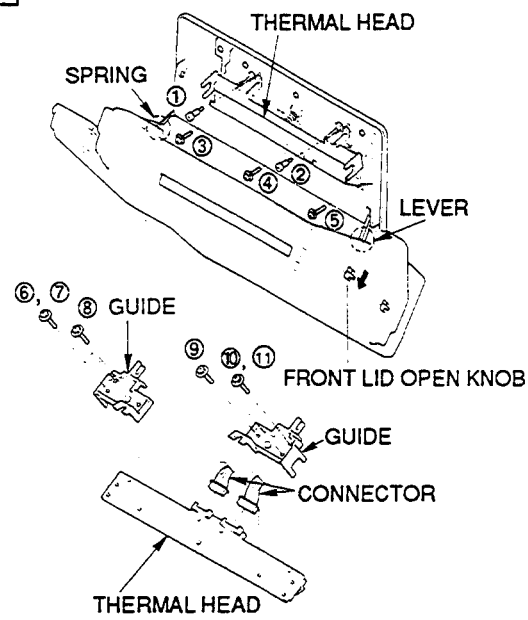


DISASSEMBLY INSTRUCTIONS

Ref. No. 1	HOW TO REMOVE THE THERMAL HEAD

Procedure 1

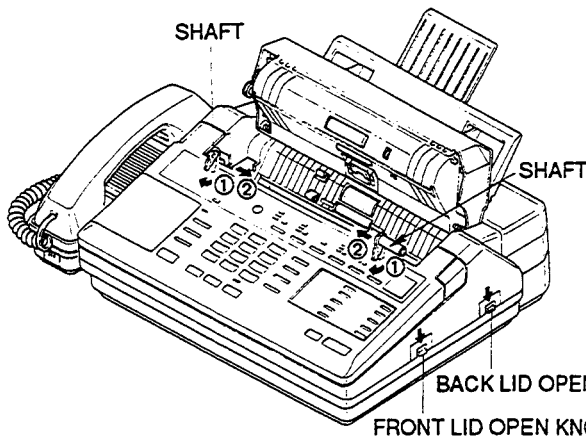
Fig. A

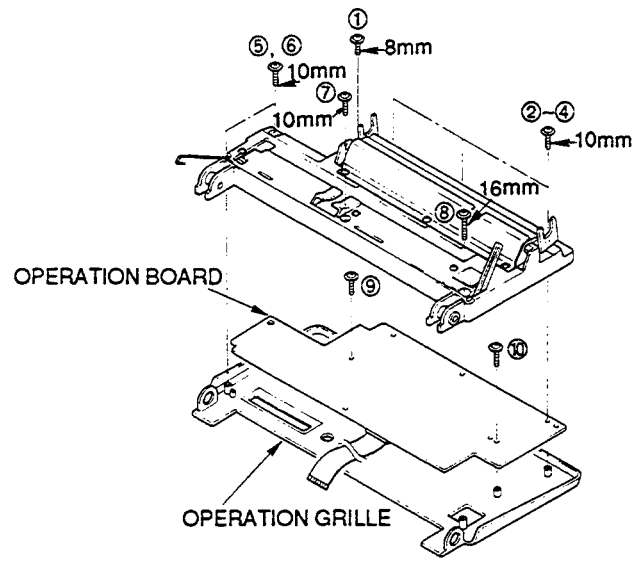


1. Push the front lid open knob.
2. Remove the 2 screws (①, ②).
3. Remove the 3 screws (③-⑤).
4. Remove the thermal head.
5. Remove the 6 screws (⑥-⑪).
6. Pull out the 2 connectors.
7. Remove the guide of the thermal head.
8. Exchange the thermal head.

Ref. No. 2	HOW TO REMOVE THE OPERATION GRILLE AND BOARD

Procedure 2

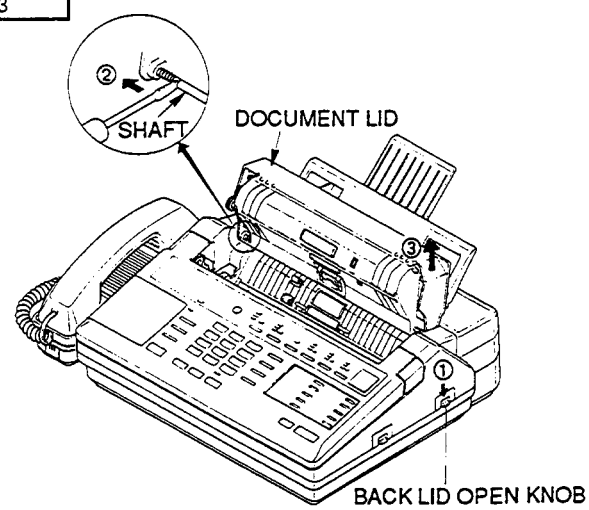


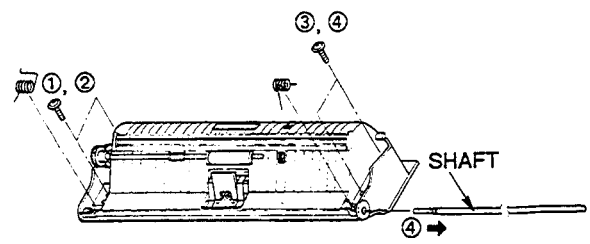


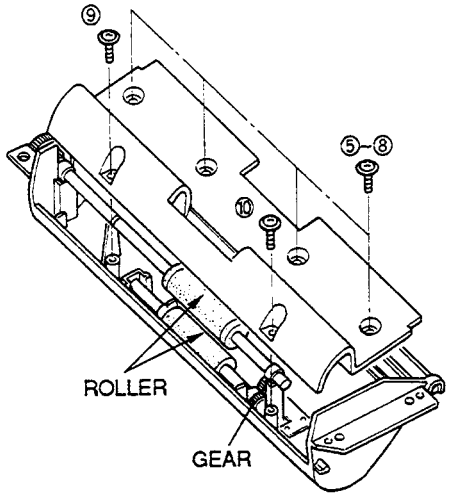
1. Push the back lid open knob.
2. Remove the 2 shafts.
3. Push the front lid open knob.
4. Remove the spring and lever. (See Fig. A).
5. Remove the 8 screws (①-⑧).
6. Remove the 2 screws (⑨, ⑩).
7. Remove the operation geille and board.

Ref. No. 3	HOW TO REMOVE THE DOCUMENT FEED ROLLERS

Procedure 3

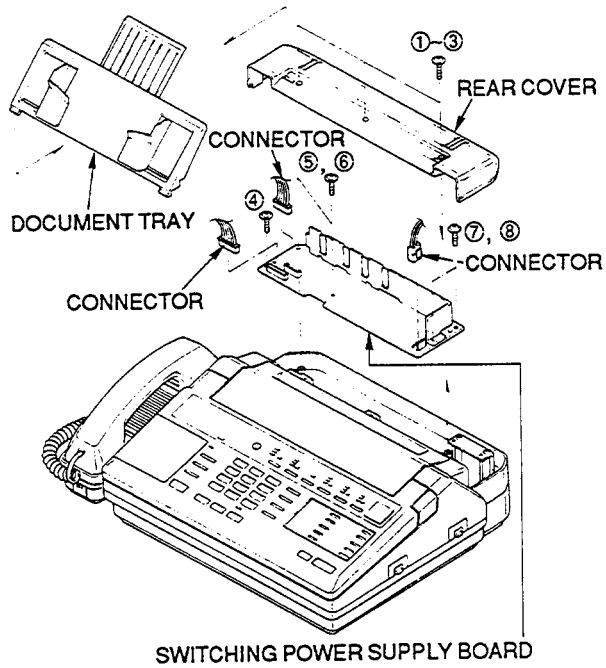






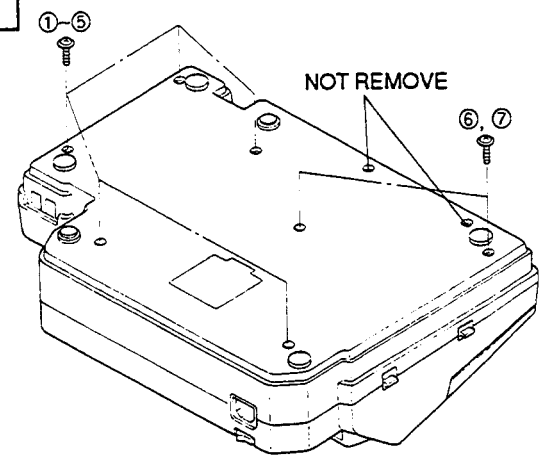
1. Open the back lid open knob.
2. Slide the shaft to the left and remove the document lid.
3. Remove the 4 screws (①-④).
4. Remove the 6 screws (⑤-⑩).
5. Exchange the rollers and gears.

Ref. No. 4	HOW TO REMOVE THE SWITCHING POWER SUPPLY BOARD
Procedure 4	



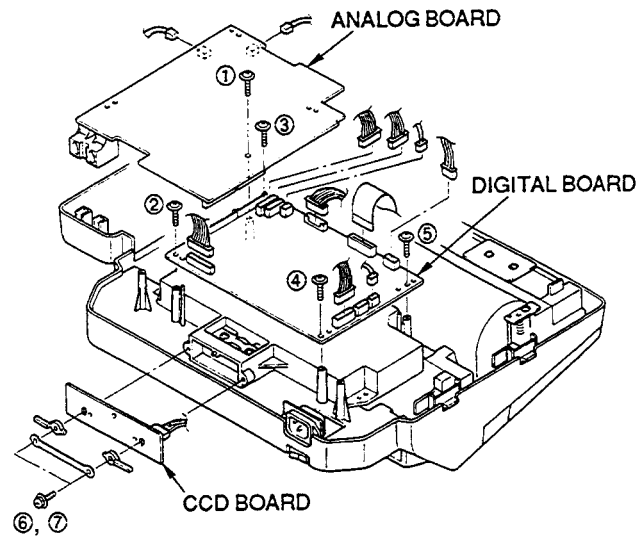
1. Remove the document tray.
2. Remove the 3 screws (①-③).
3. Remove the rear cover.
4. Remove the 5 screws (④-⑧).
5. Pull out the 3 connectors.
6. Remove the switching power supply board.

Ref. No. 5	HOW TO REMOVE THE LOWER CABINET
Procedure 5	



1. Remove the 7 screws (①-⑦).
2. Remove the lower cabinet.

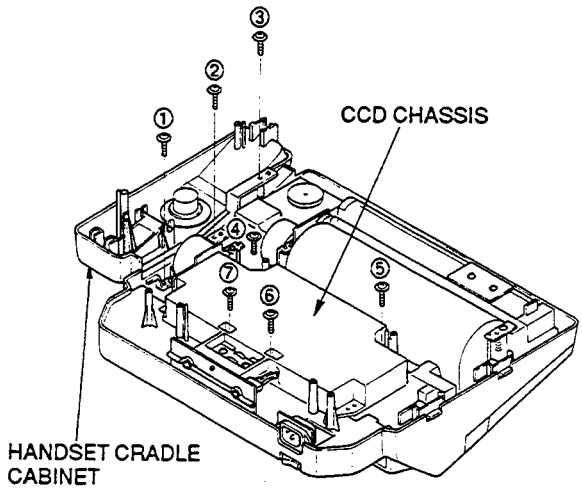
Ref. No. 6	HOW TO REMOVE THE ANALOG, DIGITAL AND CCD BOARDS
Procedure 5→6	

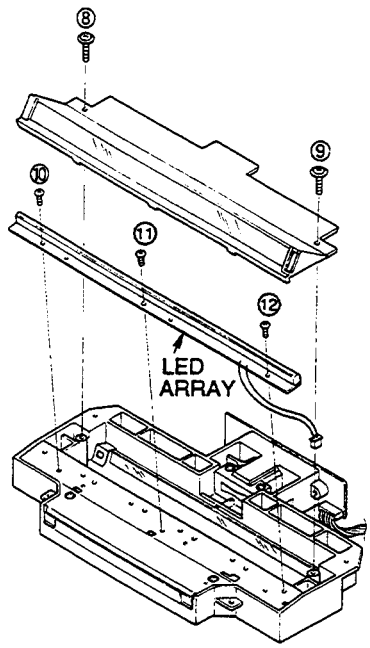


(ANALOG & DIGITAL BOARDS)
1. Remove the 2 connectors.
2. Remove the screws (①).
3. Remove the analog board.
4. Pull out the 12 connectors.
5. Remove the 4 screws (②-⑤).
6. Remove the digital board.

(CCD BOARD)
1. Remove the 2 screws (⑥-⑦).
2. Remove the CCD board.
3. CCD adjustment. (See page 52.)

Ref. No. 7	HOW TO REMOVE THE HANDSET CRADLE CABINET AND LED ARRAY
Procedure 5→6→7	

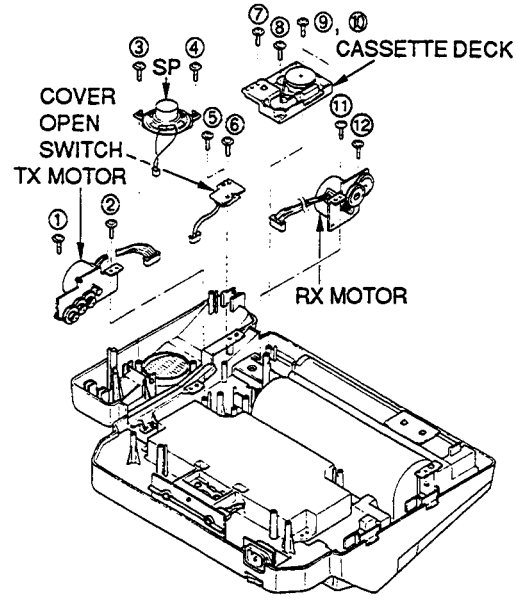




(HANDSET CRADLE CABINET)
1. Remove the 3 screws (①-③).
2. Remove the handset cradle cabinet.

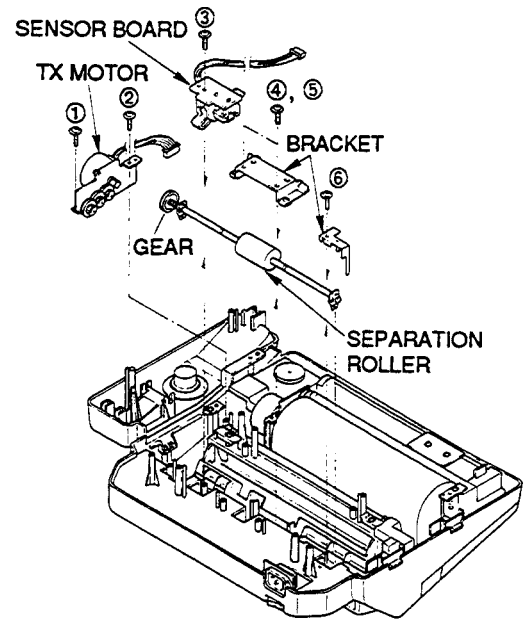
(LED ARRAY)
1. Remove the 4 screws (④-⑦).
2. Remove the CCD chassis.
3. Remove the 2 screws (⑧, ⑨).
4. Remove the 3 screws (⑩-⑫).
5. Exchange the LED array.

Ref. No. 8	HOW TO REMOVE THE MOTOR, SPEAKER, CASSETTE DECK AND COVER OPEN SWITCH
Procedure 5→6→8	

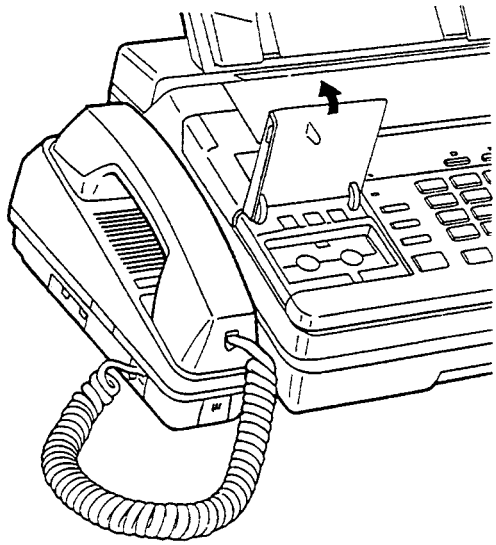


1. Remove the 12 screws (①-⑫).

Ref. No. 9	HOW TO REMOVE THE SEPARATION ROLLER AND GEAR
Procedure 5→6→7→9	



1. Remove the 6 screws.
2. Remove the bracket, motor and sensor board.
3. Exchange the separation roller or gear.

Ref. No. 10	**HOW TO REMOVE THE CASSETTE LID**
Procedure 10	

1. When removing the cassette lid, pull out in direction of arrow.
2. To reassemble, reverse the above procedure.

MEMO

HOW TO REPLACE FLAT PACKAGE IC

■ PREPARATION

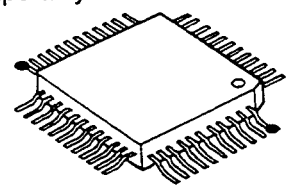
- SOLDER ..... Sparkle Solder 115A-1, 115B-1
  OR
  Almit Solder KR-19, KR-19RMA
- Soldering iron ..... Recomended power consumption will be between 30w to 40w.
  Temperature of Copper Rod 662 ±50° F (350 ±10° C)

  (An expert may handle 60~80w iron, but beginner might damage foil by overheating)
- Flux ..... HI115 Specific gravity 0.863

  (Original flux will be replaced daily.)

■ PROCEDURE

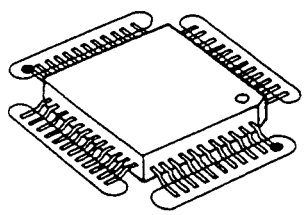
1. Temporarily fix FLAT PACKAGE IC by Soldering on two marked pins.



●.....Temporary soldering point.

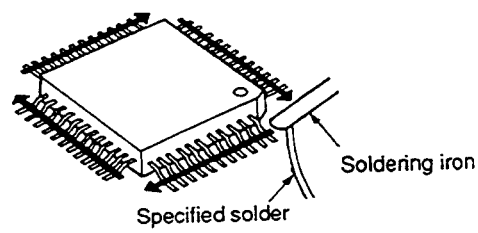
*Most important matter is accurate setting of IC to the corresponding soldering foil.

2. Apply flux for all pins of FLAT PACKAGE IC.



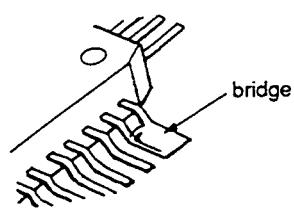
.....Flux

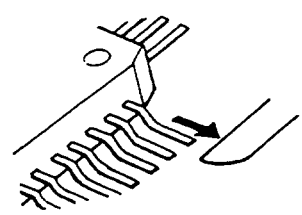
3. Solder employing specified solder to direction arrow, as slide the soldering iron.



■ MODIFICATION PROCEDURE OF BRIDGE

1. Re-solder slightly on bridged portion.
2. Remove remaining solder along pins employing soldering iron as shown in below Figure.



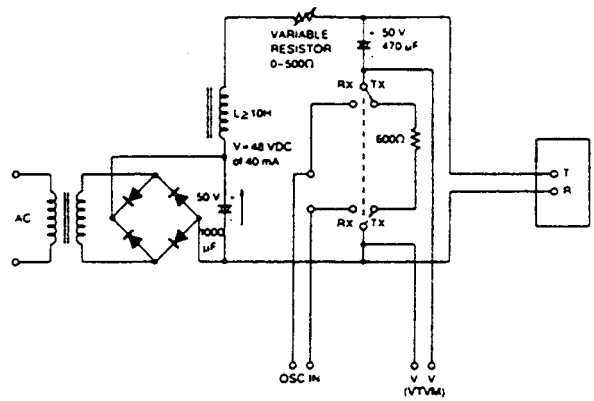


ADJUSTMENTS

1. TABLE OF TEST EQUIPMENTS AND JIG

No.	Test Equipment and Jig Name	Jig No.	Adjustment Name
1	VTVM	———	FAX Transmission Level Cassette Deck
2	Loop Simulator	———	FAX Transmission Level
3	Test Tape	QZZMWA	Cassette Deck
4	Oscilloscope	———	Cassette Deck CCD
5	Frequency Counter	———	Cassette Deck
6	CCD Jig	PQZZF50M	CCD

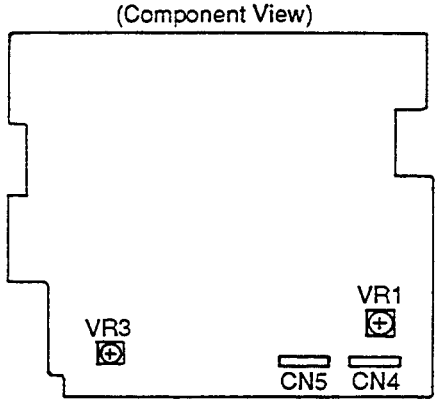
2. SCHEMATIC DIAGRAM OF LOOP SIMULATOR



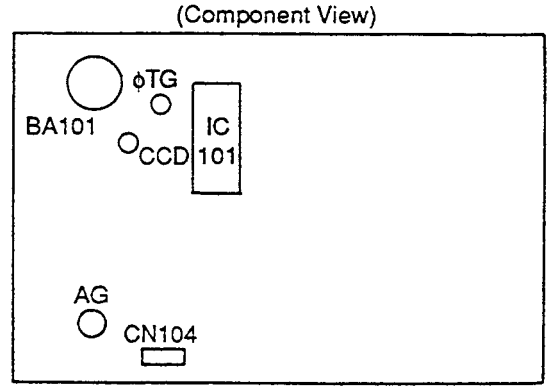
If a 48 V DC power supply is not available a 20V DC power supply can be substituted. However, the variable resistor (0–500Ω) must be set to 0 ohms.

3. LOCATION OF TEST POINT AND VR

ANALOG BOARD
(Component View)

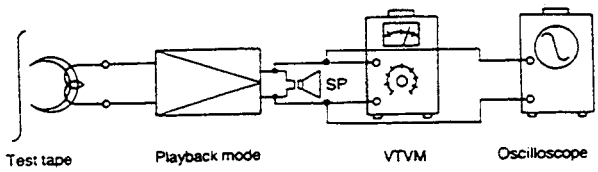
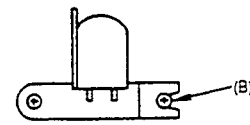
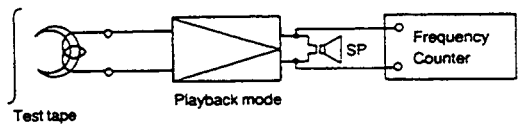


DIGITAL BOARD
(Component View)



4. CASSETTE DECK ADJUSTMENT

Notes: 1. Make sure the heads are clean.
2. Make sure the capstan and pressure roller are clean.
3. Room temperature for measuring and adjusting: 20±5°C (68±9°F)
4. Test equipments are not treated as replacement parts.

ITEM	MEASUREMENT & ADJUSTMENT	REMARKS
1. Head azimuth adjustment	1. Play back the test tape (QZZMWA). 2. Adjust screw (B) shown in Fig. A for maximum output at SP terminal. (Test equipment connection is shown below.) 	* Record/playback head  Fig. A
2. Tape speed adjustment	1. Play back the test tape (QZZMWA). 2. Adjust VR3 for 3000 ±50 Hz on frequency counter reading. 	

5. FACSIMILE TRANSMISSION LEVEL ADJUSTMENT

Perform the following adjustment after replacing FAX transmission system (IC104, T1 and VR1).

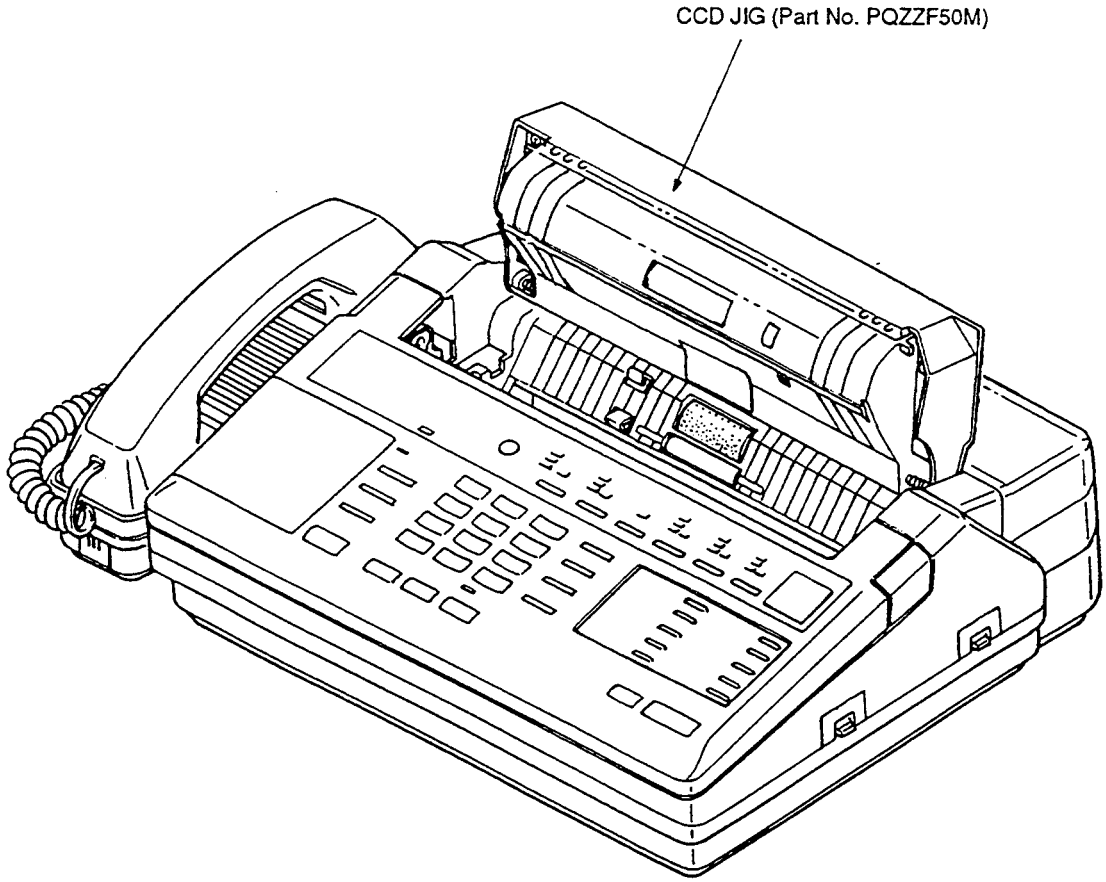
1) Connect the unit to loop simulator. (Set the selector switch to "TX".)
2) Power switch ON.
3) Press the PROGRAM button.
4) Press the #, 9, 0, 0, 0 and ✳ buttons.
5) Press the 5 and 4 buttons.
6) Press the START/COPY button.
7) Adjust VR1 for a reading of −10.5 ±0.5 dBm, on the VTVM.

6. CCD ADJUSTMENT

Perform the following adjustment after replacing lens and CCD board.

PREPARATION:

1) Remove the document lid [Refer to page 44 (Ref. No. 3)] and attach the CCD jig (PQZZF50M).
2) Oscilloscope connection as shown in the figure right.
3) Power switch ON.
4) Press the PROGRAM button.
5) Press the #, 9, 0, 0, 0 and ✳ buttons.
6) Press the 5 and 5 buttons.
7) Press the START/COPY button.



Notes:

1) When replacing the lens, pay attention to the markings on the lens are white, yellow or orange. The number of the CCD spacers to use differs depending on the markings as follows.
   *Two CCD spacers are provided with the lens.
   *Refer to page 138 for the location of the CCD spacers.

Marking on the lens	Number of CCD Spacer
Orange	0 (not used)
White	1
Yellow	2

2) Install the lens so that the making (White or Yellow or Orange) on it is upper side.
3) Do not touch the glass face of the lens with the bare hand.

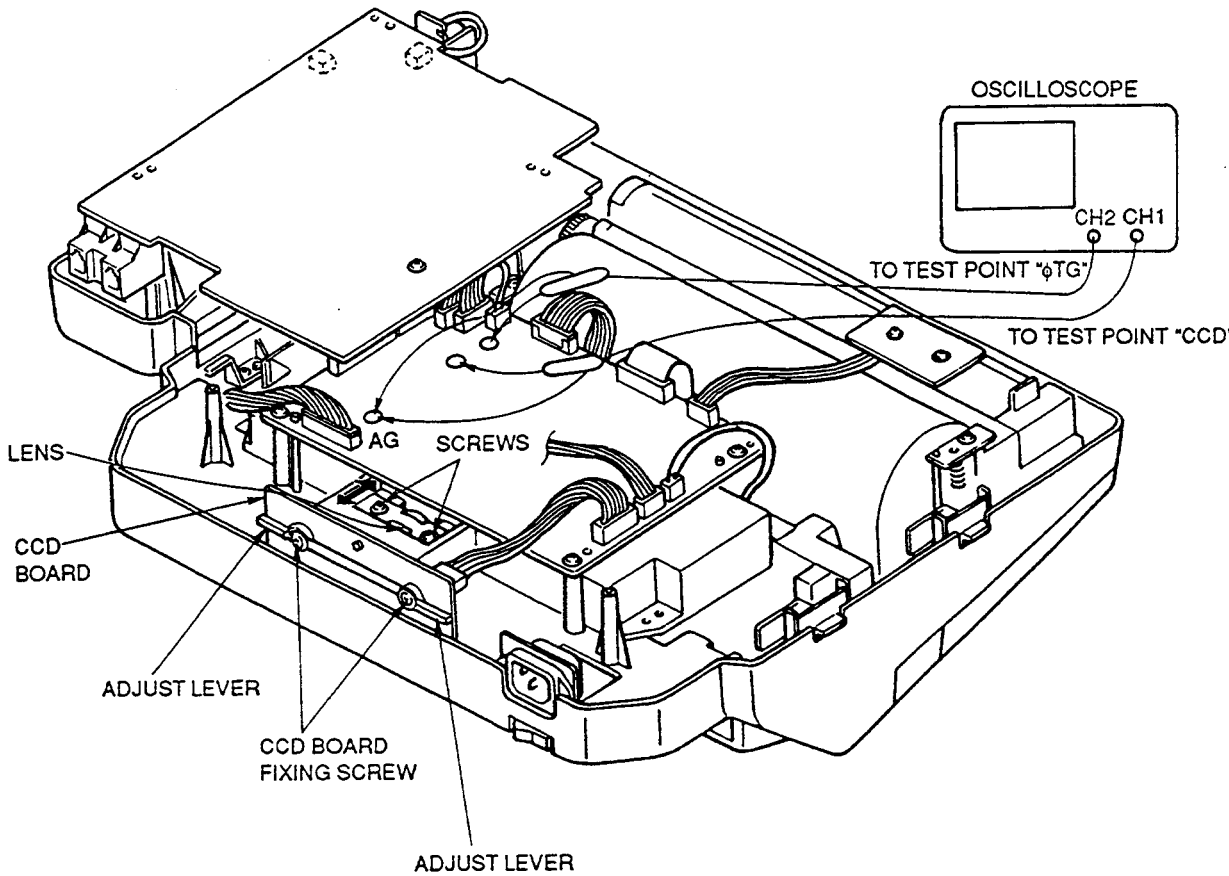
Cleaning:

If the lens is dirty, clean it with a dry soft cloth.

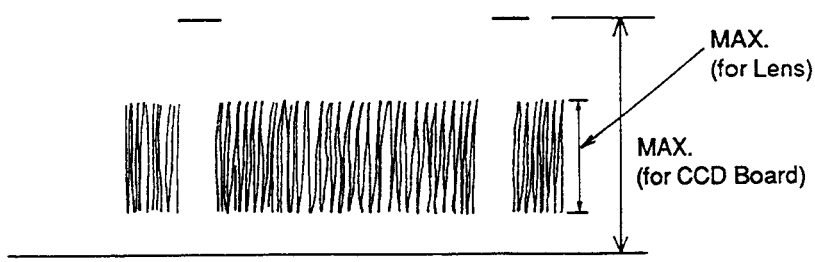
ADJUSTMENT:

LENS AND CCD READ POSITION ADJUSTMENT

1) Loosen the lens fixing screw and CCD board fixing screw.
2) Adjust the position of the lens and CCD board so that the waveform appears as shown in the figure below.
3) Fix the lens fixing screw and CCD board fixing screw.

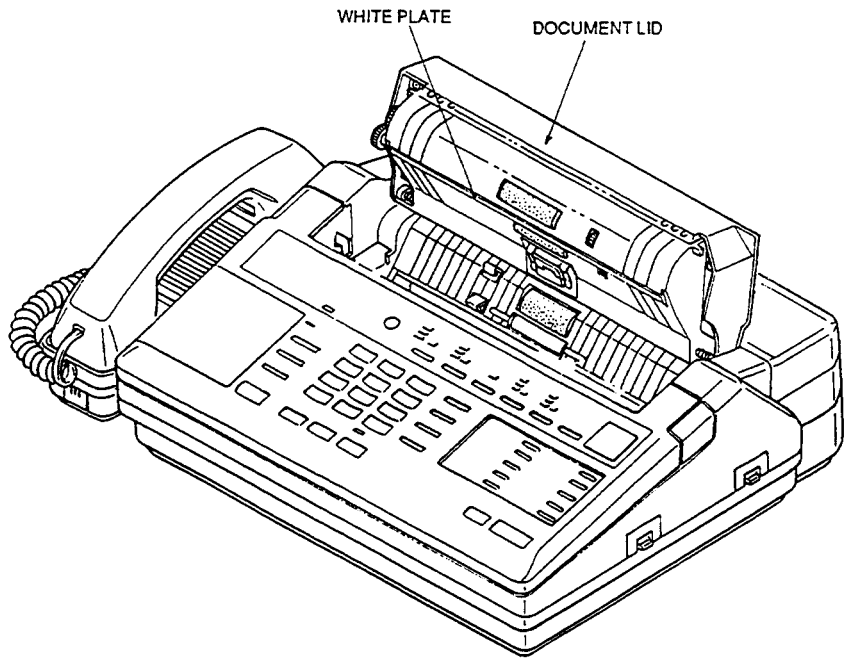


WAVEFORM



WHITE LEVEL ADJUSTMENT

1) Exchange the CCD jig (PQZZF50M) and document lid.
2) Adjust VR101 on the CCD board so that the waveform becomes 3 V.



WAVEFORM

7. DOCUMENT READ START POSITION ADJUSTMENT

1) Power Switch ON.
2) Copy the document, and confirm the read start position of the document.
3) If get out of position, adjust the read position.
4) Press the PROGRAM button.
5) Press the #, 9, 0, 0, 0, ✳ and 6 buttons.
6) Press the 3,□,□, SET and PROGRAM buttons.

30
⋮ To move the image to the right direction
16 ↑
15 ← Standard (Default)
14 ↓
⋮ To move the image to the left direction
0

* The starting position of the reading shifts 1 mm as the numbers changes.

CIRCUIT OPERATIONS

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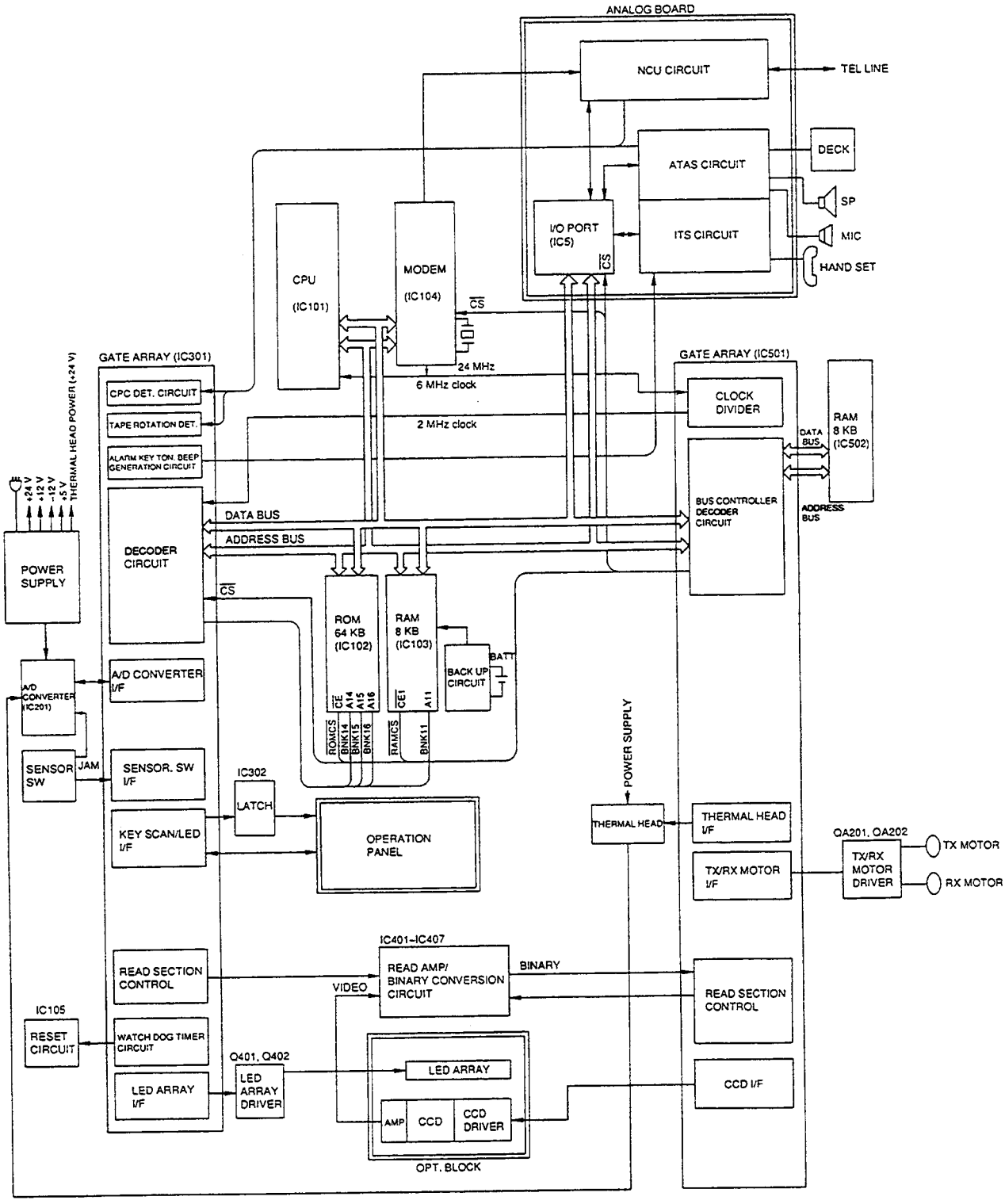
NOTE
The circuit diagram may be modified at any time with the development of new technology.

1. GENERAL BLOCK DIAGRAM

1) CPU (IC101)	Fetch and executes instruction from ROM, writes (read) data to (from) RAM, writes commands to the gate array IC's and reads status information from gate array IC's.
2) ROM (IC102)	Contains all of the program instructions for unit operation.
3) RAM (IC103)	Working storage area (Auto dial number etc) backed up by a lithium battery.
4) RAM (IC502)	Used mainly for image processing.
5) GATE ARRAY ..... (IC301)	Composed mainly key scan/LED I/F and some circuits for controlling analog section.
6) GATE ARRAY ..... (IC501)	Controls the general FAX operation.
7) Reset circuit (IC105)	Provides reset pulse to each of the major IC's.
8) Memory Back up ..... circuit (BA101)	Back up RAM (IC103).
9) A/D Converter ..... (IC201)	Detect temperature of thermal head and power supply, and paper Jam condition.
10) MOTOR DRIVER ..... (QA201, QA202)	DRIVE TX MOTOR and RX MOTOR.
11) READING Section	Composed of Read Amp, Binary conversion circuit and OPT. Block. OPT Block is composed of LED ARRAY, Mirror Lens, CCD, CCD DRIVER and so on. They execute reading of the transmission document.
12) Thermal Head	Contains heating elements for dot matrix image printing.
13) MODEM (IC104)	Executes modulation and demodulation for FAX communication.
14) Operation grille	Composed of many keys and LEDs.
15) Analog Board	Composed of ITS, ATAS and NCU circuit. each circuit is controlled by I/O port (IC5), +6 V power is regulated from +12 V in this Board.
16) Sensor Section	Document sensor, Reading position sensor, Cover open sensor, recording paper sensor.
17) Switching power supply ...	Supply +24 V, ±12 V, +5 V and Thermal head power (+24 V).

Block Diagram

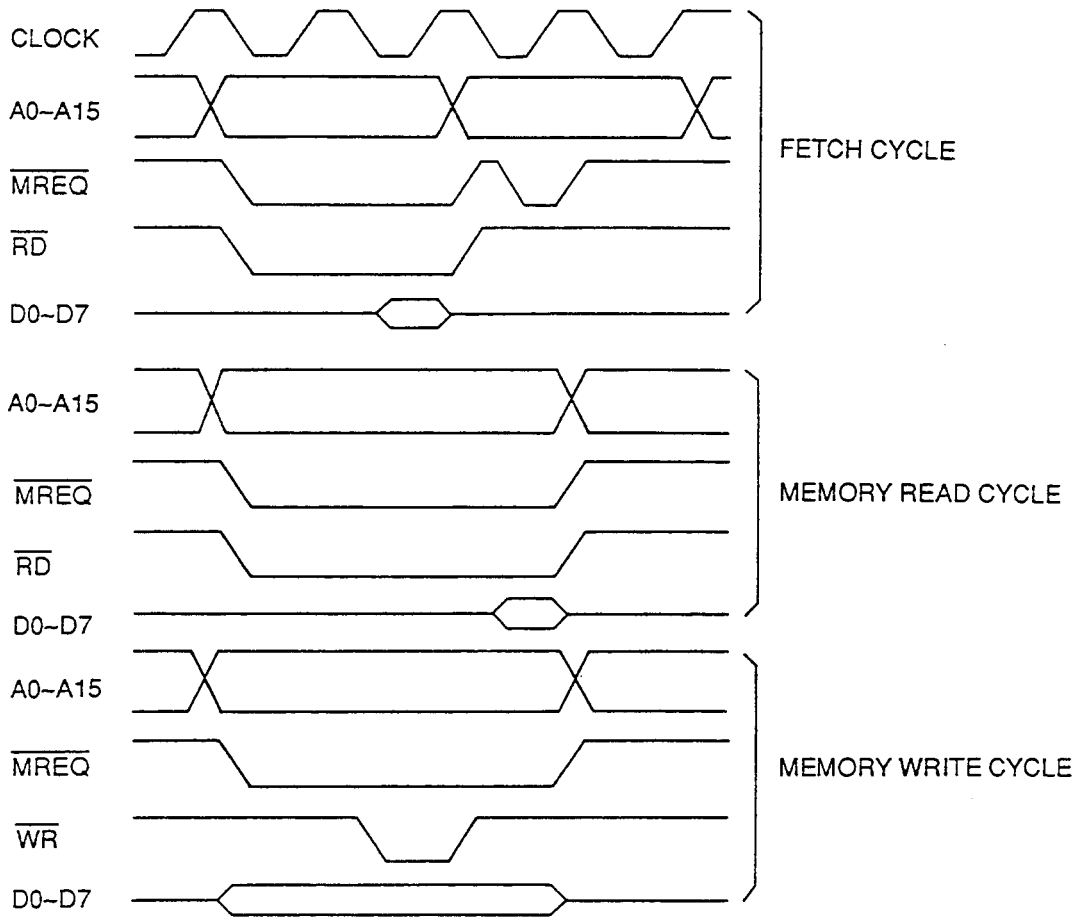


2. CONTROL SECTION

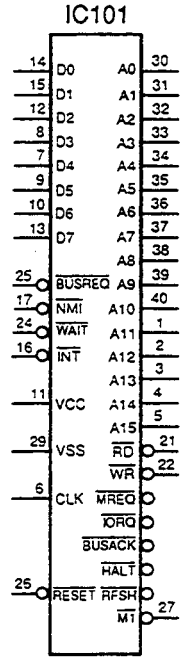
2-1. CPU (IC101)

The KX-F50 uses a Z80 equivalent CPU operating at 6 MHz. Many of the peripheral functions are handled by custom designed LSI gate arrays. As a result, the CPU only needs to process the results. Fetch, read and write cycle timing chart is shown below.

Timing Chart

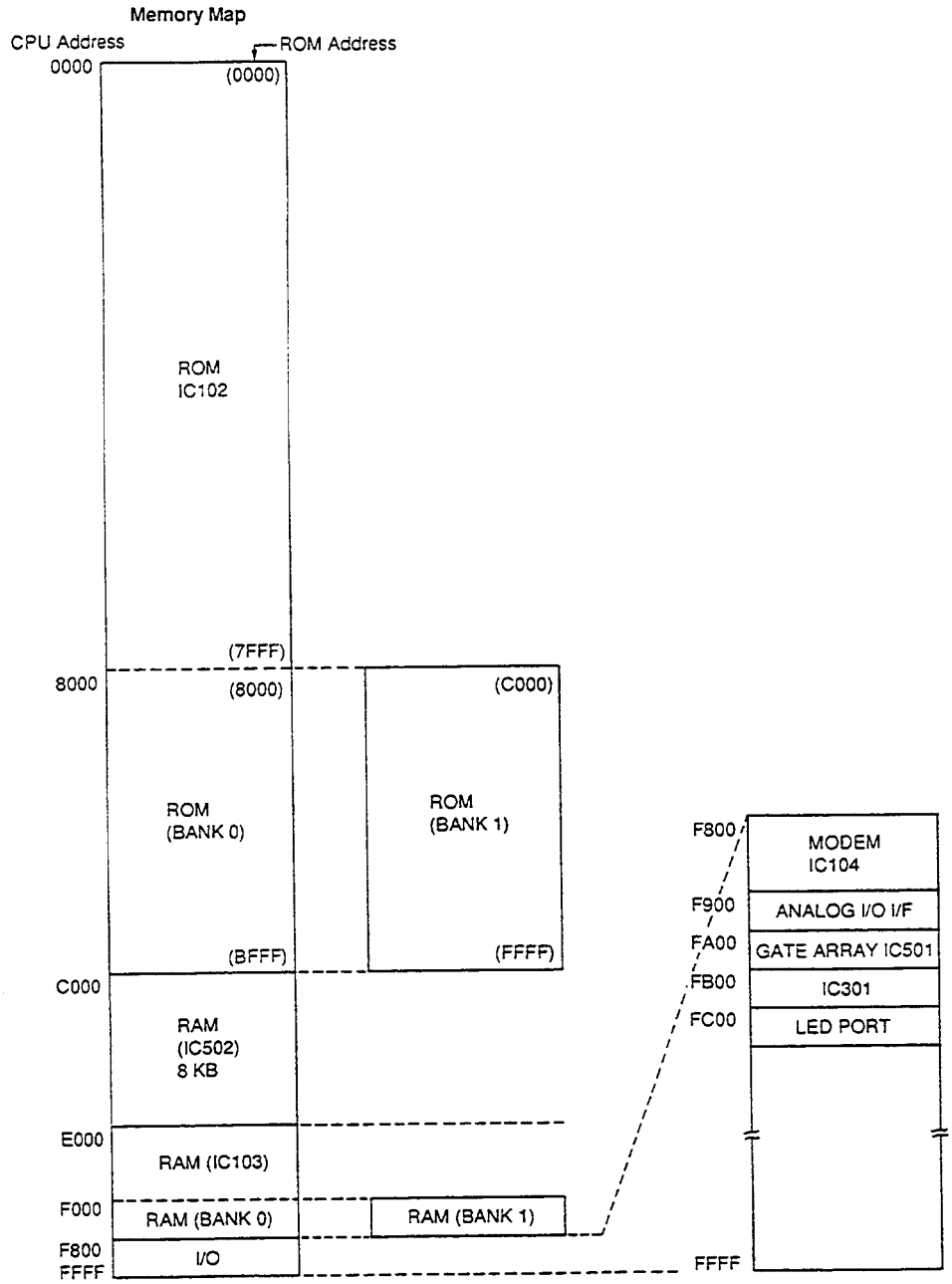


IC101



2-2. ROM (IC102)

This unit uses a programmed 64KB EP-ROM to store all of the operating instructions for the Automatic Telephone Answering System and Facsimile operations. The CPU can access only 48KB of the ROM area at a time, so the CPU access 32KB of the ROM area as a common area, and access the last 32 KB of it as two 16KB bank ROM areas.



2-3. RAM (IC103)

This 8KB area is the CPU working storage area.
Auto dial number, ID and logo data and all user programmable functions are stored in this area and it is backed up by a lithium battery.
4KB of this RAM area is accessed as a common RAM area by CPU, and the last 4KB of it is accessed as two 2KB bank RAM areas.

2-4. RAM (IC502)

This 8KB area is divided into 32 image data storage areas, these areas are controlled by Gate Array IC (IC501).

2-5. GATE ARRAY (IC301)

This is a custom IC for the analog circuit used for key input, LED control and to generate and detect signals.

1) **Memory Bank Switch Section**
The ROM/RAM bank switching signals are generated.

2) **Clock Frequency Division Section**
Frequency division is executed to generate the special clocks for the various parts.

3) **Watch Dog Timer Section**
A pulse is sent to the reset circuit to prevent a loop condition in the software program.

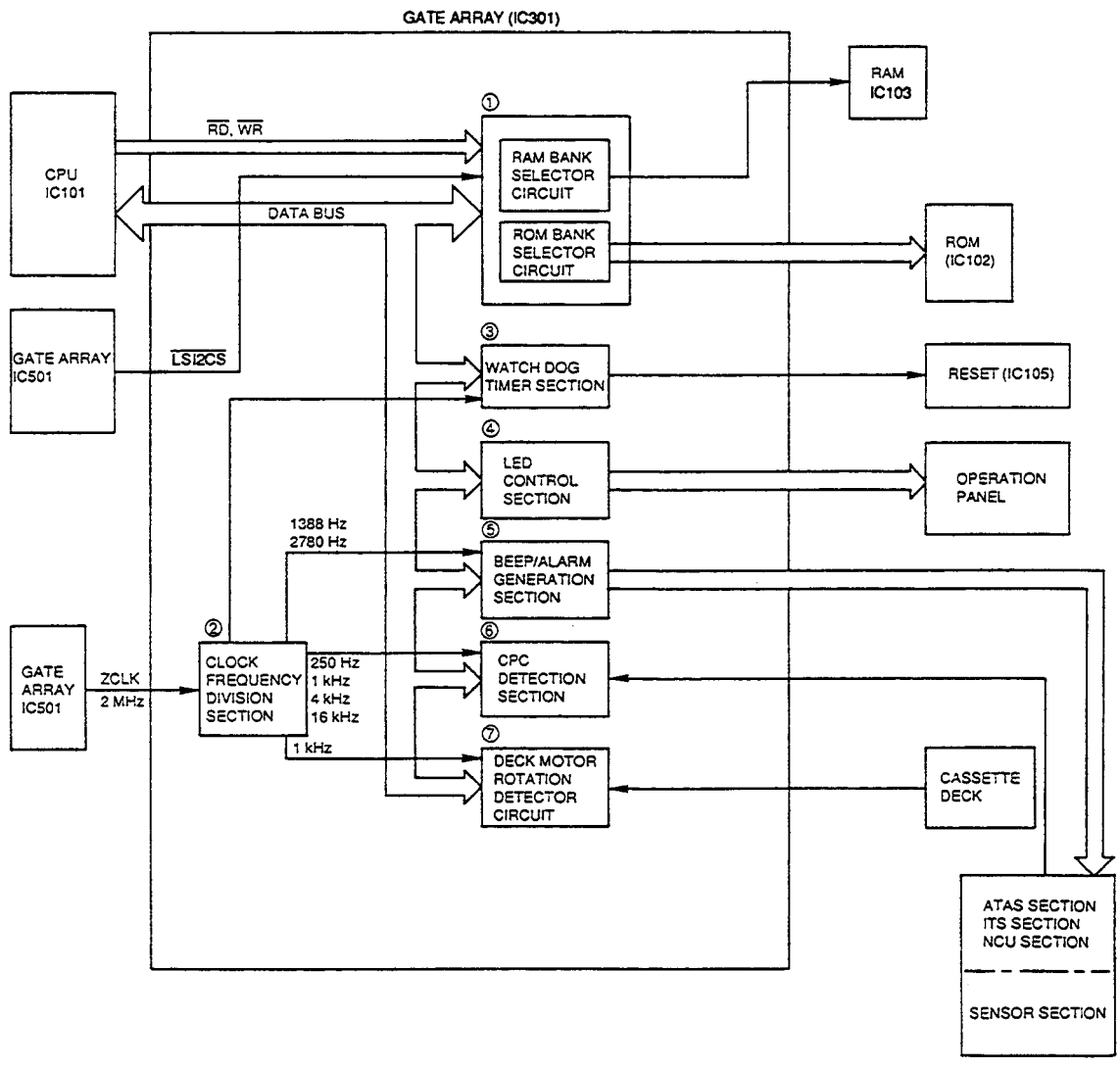
4) **LED Control Section**
A signal is generated to control the LEDs on the operation panel.

5) **Beep (1388 Hz)/Alarm Tone (2780 Hz) Generation Section**
The beep for ATAS record/playback, key tone and alarm tone are generated.

6) **CPC Detection Section**
The length of the CPC signal from the NCU circuit is counted, and checking is executed to determine whether it is the CPC signal or not. For details in regard to the CPC detection circuit, refer to the respective page.

7) **Cassette Deck Motor Rotation Detector Section**
Rotation of the cassette reel motor is monitored to detect end of tape or tape jam.

Block Diagram



8) Explanation of Pin Distribution (IC301)

Signal	Pin No.	I/O	Function	Description
D0	79	I/O	Data Bus	CPU (Z80) Data Bus
D1	78	I/O	Data Bus	CPU (Z80) Data Bus
D2	77	I/O	Data Bus	CPU (Z80) Data Bus
D3	76	I/O	Data Bus	CPU (Z80) Data Bus
D4	75	I/O	Data Bus	CPU (Z80) Data Bus
D5	74	I/O	Data Bus	CPU (Z80) Data Bus
D6	72	I/O	Data Bus	CPU (Z80) Data Bus
D7	71	I/O	Data Bus	CPU (Z80) Data Bus
A0	69	I	Address Bus	CPU (Z80) Address Bus
A1	68	I	Address Bus	CPU (Z80) Address Bus
A2	67	I	Address Bus	CPU (Z80) Address Bus
A3	66	I	Address Bus	CPU (Z80) Address Bus
A11	64	I	Address Bus	CPU (Z80) Address Bus
A12	63	I	Address Bus	CPU (Z80) Address Bus
A14	62	I	Address Bus	CPU (Z80) Address Bus
A15	61	I	Address Bus	CPU (Z80) Address Bus
$\overline{RD}$	60	I	Read Status Signal	
$\overline{WR}$	59	I	Write Status Signal	
$\overline{LSI2CS}$	65	I	Chip Select Signal for this IC	
CLK2	11	I	System Clock (2 MHz)	
$\overline{RSTIN}$	10	I	System Reset	
$\overline{WDERR}$	54	O	Watch Dog Error Signal	
$\overline{TEST}$	50	I	Test Signal	
CPC	47	I	CPC Signal Input	
RVN	51	I	RVN Signal Input	
BEEP	45	O	Beep Output (1388 Hz)	
ALARM	44	O	Alarm Output (2780 Hz)	
KEYT	46	O	Key Tone Output (1388 Hz)	
FCLK	43	O	Clock for Filter Output (110 Hz)	
$\overline{ADCS}$	5	O	Chip Select Pulse for the A/D Converter	
ADCLK	7	O	Clock for the A/D Converter	
ADSO	8	I	Conversion Data for the A/D Converter	
ADSI	6	O	Channel Specification Data for the A/D Converter	
$\overline{LED1}$	39	O	Output Port LED1	"0": LED ON "1": LED OFF
$\overline{LED2}$	38	O	Output Port LED1	"0": LED ON "1": LED OFF
$\overline{LED3}$	37	O	Output Port LED1	"0": LED ON "1": LED OFF
$\overline{LED4}$	36	O	Output Port LED1	"0": LED ON "1": LED OFF
$\overline{LED5}$	35	O	Output Port LED1	"0": LED ON "1": LED OFF
$\overline{LED6}$	34	O	Output Port LED1	"0": LED ON "1": LED OFF
$\overline{LED7}$	32	O	Output Port LED1	"0": LED ON "1": LED OFF
$\overline{LED8}$	30	O	Output Port LED1	"0": LED ON "1": LED OFF
$\overline{LED9}$	29	O	Output Port LED1	"0": LED ON "1": LED OFF

Signal	Pin No.	I/O	Function	Description
$\overline{\text{LED10}}$	28	I/O	Input/Output Port (Not Used)	
$\overline{\text{LED11}}$	27	I/O	Enabling Signal for LED10–14	"0": Enable "1": Disable
HEADENB	53	O	Thermal Head Power Supply Control	"1": Power ON "0": Power OFF
LIGHT	4	O	Light Supply Control	"1": LED ON "0": LED OFF
DARK	1	O		
CABLE1	49	O		
CABLE2	48	O		
$\overline{\text{KEYIN0}}$	20	I	Input Port	
$\overline{\text{KEYIN1}}$	19	I	Input Port	
$\overline{\text{KEYIN2}}$	18	I	Input Port	
$\overline{\text{KEYIN3}}$	17	I	Input Port	
$\overline{\text{KEYIN4}}$	16	I	Input Port	
$\overline{\text{KEYIN5}}$	15	I	Input Port	
$\overline{\text{KEYIN6}}$	14	I	Input Port	
$\overline{\text{KEYIN7}}$	13	I	Input Port	
$\overline{\text{KEYSTB0}}$	26	O	Output Port	
$\overline{\text{KEYSTB1}}$	25	O	Output Port	
$\overline{\text{KEYSTB2}}$	24	O	Output Port	
$\overline{\text{KEYSTB3}}$	23	O	Output Port	
$\overline{\text{KEYSTB4}}$	22	O	Output Port	
$\overline{\text{KEYSTB5}}$	21	O	Output Port	
RCOVER	41	I	R Cover Open Sensor Input	
SCOVER	42	I	S Cover Open Sensor Input	
PAPER	9	I	Recording Paper Sensor Input	
DOC	2	I	Document Sensor Input	
READ	3	I	Read Position Sensor Input	
BA16	55	O	ROM Address 16	
BA15	56	O	ROM Address 15	
BA14	57	O	ROM Address 14	
BA11	58	O	RAM Address 11	
+5 V	33			
+5 V	40			
+5 V	73			
GND	12			
GND	31			
GND	52			
GND	70			
GND	80			

2-6. GATE ARRAY (IC501)

This custom IC handles the general FAX operation of this unit. This IC can be divided roughly into 6 sections, which are explained below.

1) **Decode/Register Section**
The Address bus, $\overline{RD}$ and $\overline{WR}$ from CPU are decoded, and chip select signal are sent to ROM (IC102), RAM (IC103, 502), Gate Array (IC301), Modem (IC104) and Gate Array (IC501) internal registers. Internal registers control the following sections.

2) **Clock Creation Section**
Frequency division is executed for the 6 MHz clock from the modem (IC104), and the 2 MHz clock for the Gate Array (IC301) and the special clocks for each block are generated.

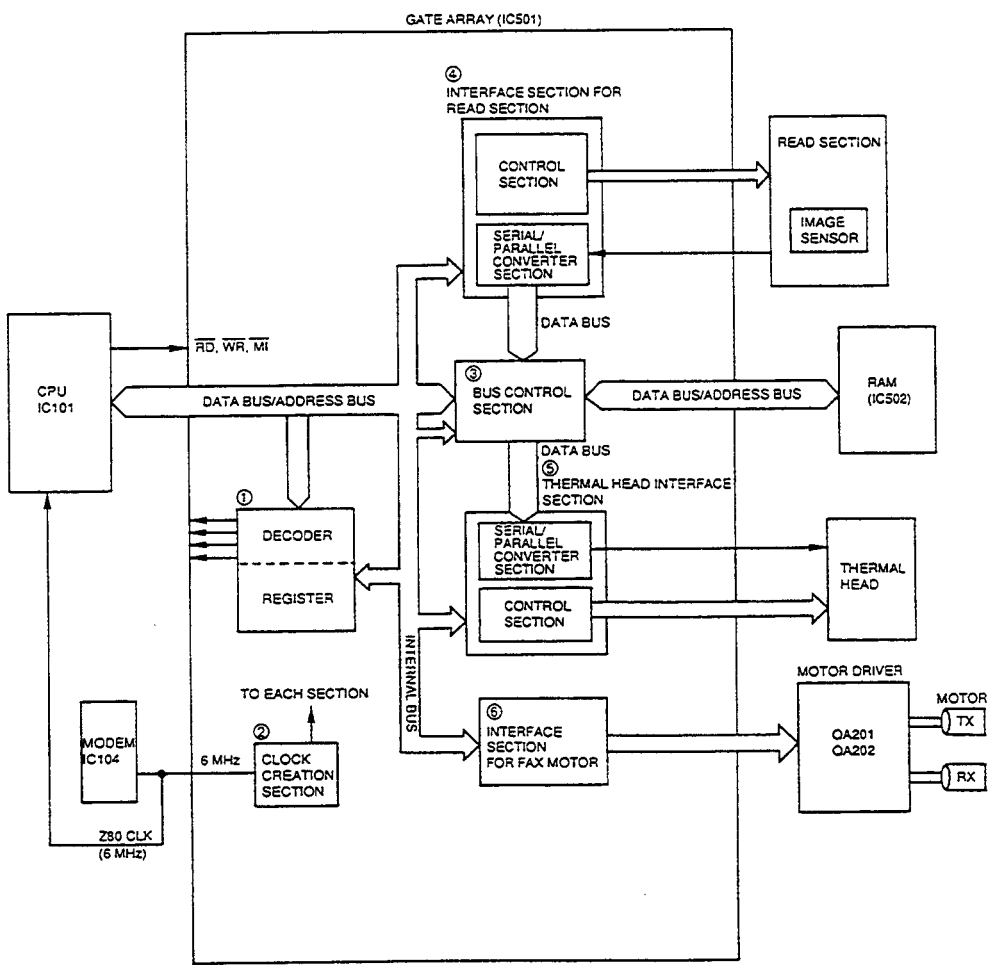
3) **Bus Control Section**
The data buses between CPU (IC101), RAM (IC502), and thermal head parallel/serial conversion section and read serial/parallel conversion section are connected.

4) **Interface Section with the Read Section**
This is composed of the control section for the read section and the part for conversion of the serial image data from the read section to parallel data.

5) **Interface Section with the Thermal Head Section**
This is composed of the control section for the read section and the part for conversion of the parallel image data on the data bus to serial data for the thermal head.

6) **Interface Section with the FAX Motor Section**
This section controls the FAX transmission and reception motors.

Circuit Diagram



7) Explanation of Pin Distribution (IC501)

Signal	Pin No.	I/O	Function
D0	90	I/O	System Data Bus
D1	89	I/O	
D2	88	I/O	
D3	87	I/O	
D4	85	I/O	
D5	84	I/O	
D6	83	I/O	
D7	82	I/O	
A0	7	I	System Address Bus LSB 8 bit
A1	6	I	
A2	5	I	
A3	4	I	
A4	3	I	
A5	2	I	
A6	1	I	
A7	100	I	
A8	99	I	System Address Bus MSB 8 bit
A9	98	I	
A10	97	I	
A11	96	I	
A12	95	I	
A13	94	I	
A14	93	I	
A15	92	I	
SD0	31	I/O	Local Data Bus (8 bit)
SD1	30	I/O	
SD2	29	I/O	
SD3	54	I/O	
SD4	53	I/O	
SD5	52	I/O	
SD6	51	I/O	
SD7	50	I/O	

Signal	Pin No.	I/O	Function
SA0	32	O	Local Address Bus (LSB 8 bit)
SA1	33	O	
SA2	34	O	
SA3	35	O	
SA4	37	O	
SA5	38	O	
SA6	39	O	
SA7	40	O	
SA8	44	O	Local Address Bus (MSB 5 bit)
SA9	45	O	
SA10	49	O	
SA11	46	O	
SA12	42	O	
$\overline{MI}$	10	I	Machine Cycle 1 Signal
$\overline{RD}$	8	I	Read
$\overline{WR}$	9	I	Write
$\overline{RAMOE}$	48	O	$\overline{RD}$ Terminal for Local Memory
$\overline{RAMWR}$	43	O	$\overline{WR}$ Terminal for Local Memory
TXE	68	O	Transmitting Motor Control Signal
RXE	73	O	Receiving Motor Control Signal
$\overline{MDMCS}$	79	O	Modem Chip Select
$\overline{ROMCS}$	80	O	ROM Chip Select
$\overline{RAMCS}$	81	O	Work RAM Chip Select
$\overline{AIOCS}$	78	O	Analog Circuit G/A Chip Select
$\overline{LSI2CS}$	27	O	G/A2 Chip Select
$\overline{RESCS}$	12	O	LED Port Chip Select
$\overline{RSTIN}$	13	I	Power ON Reset Input
$\overline{INT}$	11	O	Interrupt Signal to CPU
VIDRST	26	O	Clock for Direct Current Rebirth Circuit
$\overline{Ø2}$	18	O	Transfer Clock for CCD
$\overline{ØTG}$	19	O	Shift Clock for CCD
$\overline{ØR}$	20	O	Reset Clock for CCD
$\overline{Ø1}$	21	O	Transfer Clock 1 for CCD
BLCLK	22	O	Clock for Regenerate Black Level

Signal	Pin No.	I/O	Function
S/H CLK	23	O	Sample Hold Clock
RIXDATA	24	I	Read Image Signal (Pix Data)
$\overline{\text{AGCE}}$	25	O	AGC Range Specification Set
$\overline{\text{THRCK}}$	56	O	Thermal Head Transfer Clock
THLCH	57	O	Thermal Head Latch Signal
STB0	66	O	Thermal Head Strobe Signal
STB1	64	O	
STB2	63	O	
STB3	62	O	
STB4	61	O	
STB5	60	O	
STB6	59	O	
STB7	58	O	
THDAT	55	O	Thermal Head Image Signal
STBNP	67	I	Strobe Polar Designation
TM0	72	O	Excitation Pulse for Transmitting Motor
TM1	71	O	
TM2	70	O	
TM3	69	O	
RM0	77	O	Excitation Pulse for Receiving Motor
RM1	76	O	
RM2	75	O	
RM3	74	O	
CLK1	14	I	System Clock Input (6 MHz)
CLK2	28	O	Clock Output (2 MHz)
$\overline{\text{TEST}}$	16	I	Test Terminal
+5 V	41	—	Power Supply Terminal (+5 V)
+5 V	91	—	Power Supply Terminal (+5 V)
GND	15	—	GND Terminal (0 V)
GND	17	—	GND Terminal (0 V)
GND	36	—	GND Terminal (0 V)
GND	47	—	GND Terminal (0 V)
GND	65	—	GND Terminal (0 V)
GND	86	—	GND Terminal (0 V)

2-7. MODEM (IC104)

This IC facilitates modulation and demodulation of data for FAX communications. Since it conforms to communication sequences stipulated in CCITT, it can be controlled from the CPU (IC101) by writing in instruction commands with chip select signals $\overline{\text{MDMCS}}$ and address buses A0~A4 to the 32 individual registers in the Modem (IC104). Details will be discussed later.

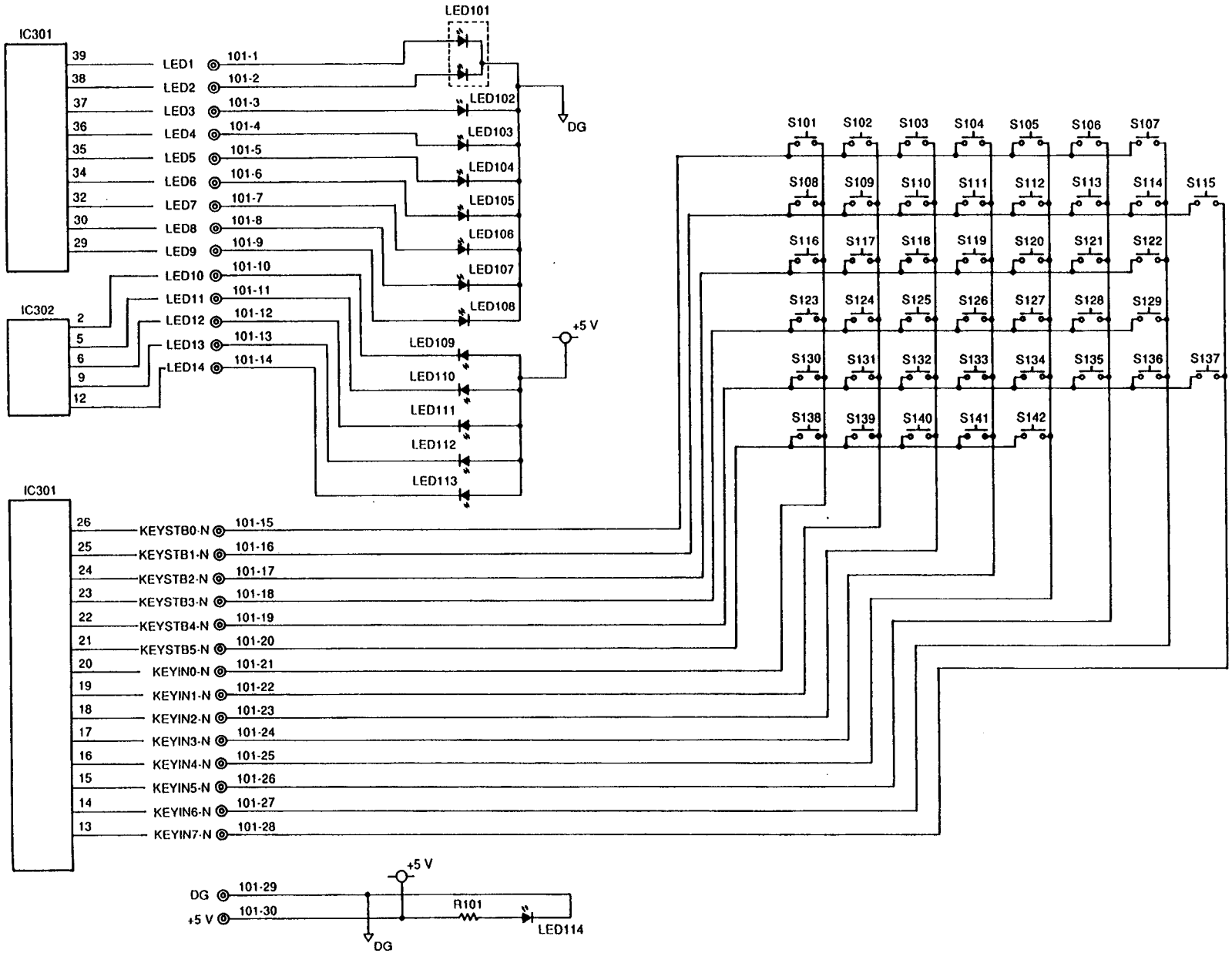
2-8. LED PORT (IC302)

This port is an expansion LED port. Nine of the fourteen LED control signals are generated in the Gate Array (IC301), and five signals in the LED port (IC302).

2-9. OPERATION BOARD

14 LED and 42 switches are mounted on this board, LED 101 is a two-colour LED, lights red or green. 8 LEDs (LED101~108) are controled by IC 101 via IC 301 (29, 30, 32, 34~39). When signals of these pins are at low level, output transistors (Q301~309) become ON, and current is supplied to these LEDs.
LED 114 is a power indicator, lighting while power ON, 5 LEDs (LED 109~113) are controled by IC101 via IC302. When low sent data is to IC302 (2, 5, 6, 9, 12), current is supplied to these LEDs from +5 V, S101~142 are operation key switches. A switch is pushed when keystb signal of this is at low level, low level is input to I/O port of IC301.

Circuit Diagram



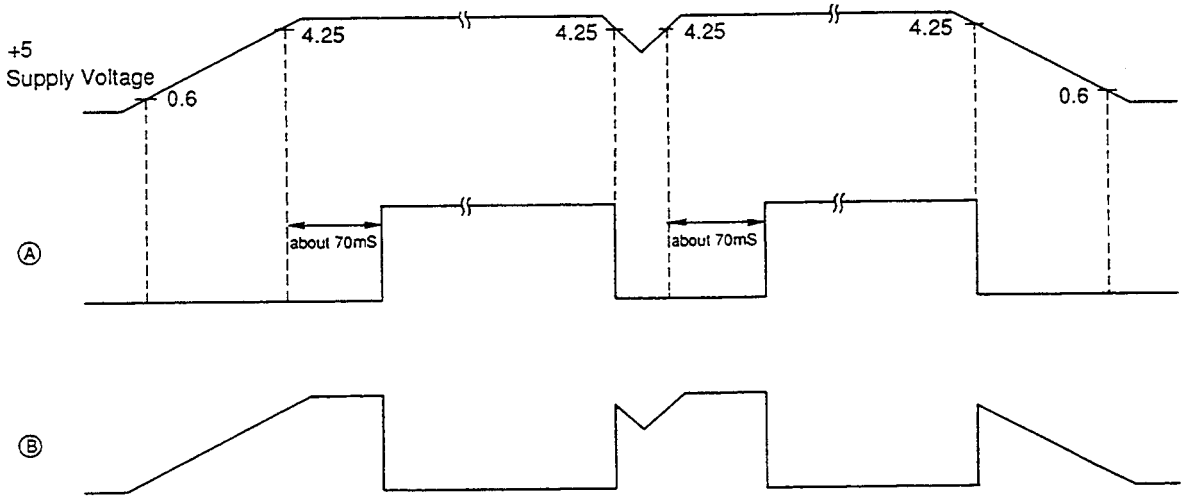
2-10. RESET CIRCUIT

1) Circuit Operation

The output from pin 5 of IC105 resets the gate array (IC501), the gate array (IC301), Analog section, the CPU (IC101) and the modem (IC104). Reset is performed in the following instances.

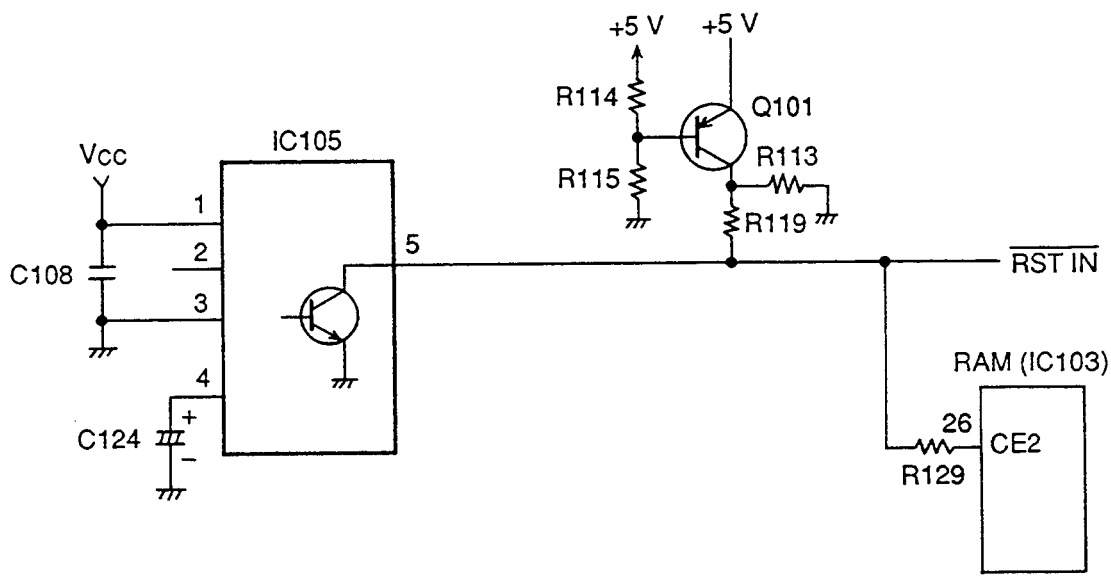
(1) During to momentary power interruption, a positive reset pulse of 70 msec or more is generated and the system is reset completely. This is done to prevent partial resetting and system runaway during power fluctuation.

Timing Chart



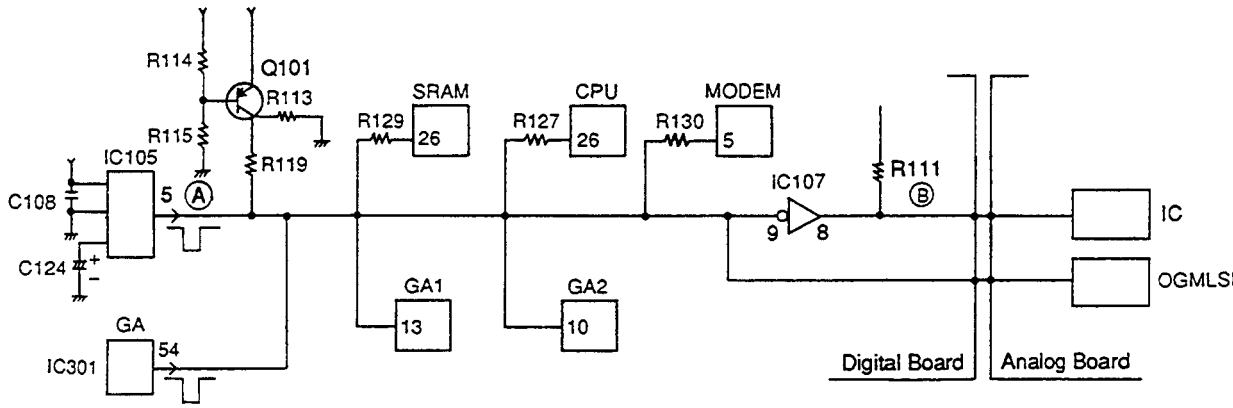
(2) An open collector output exists at pin 5 terminal. This is shown in the circuit diagram, and at the time of resetting, the internal transistor becomes ON and pin 5 becomes low level, so this low level prevents a change of the memory data that is backed up by the lithium battery.

Circuit Diagram



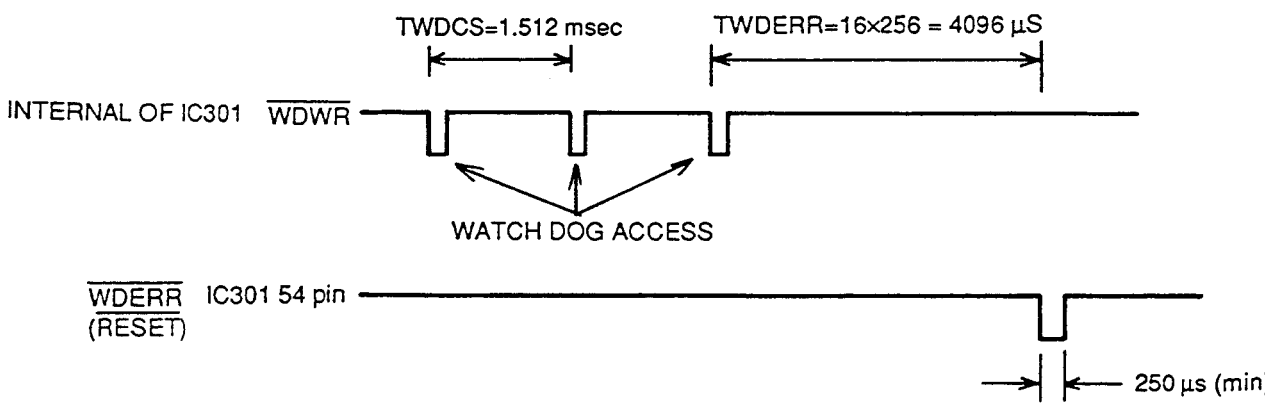
(3) Another pulse that can reset all of the circuit named WDERR (pin 54 of IC301) is the output of watch-dog timer.
The terminal of WDERR signal is connected to the reset line mentioned above.
So WDERR signal works as the reset signal.
The principle of the watch-dog timer is mentioned below, (4).

Circuit Diagram



(4) The watch-dog timer circuit is built in the gate array (IC301), and it is initialized by the CPU (IC101) at intervals of 1.512 ms. When a watch-dog error occurs in case of system runaway, pin 54 of IC301 becomes low level for 250 µs.

Timing Chart

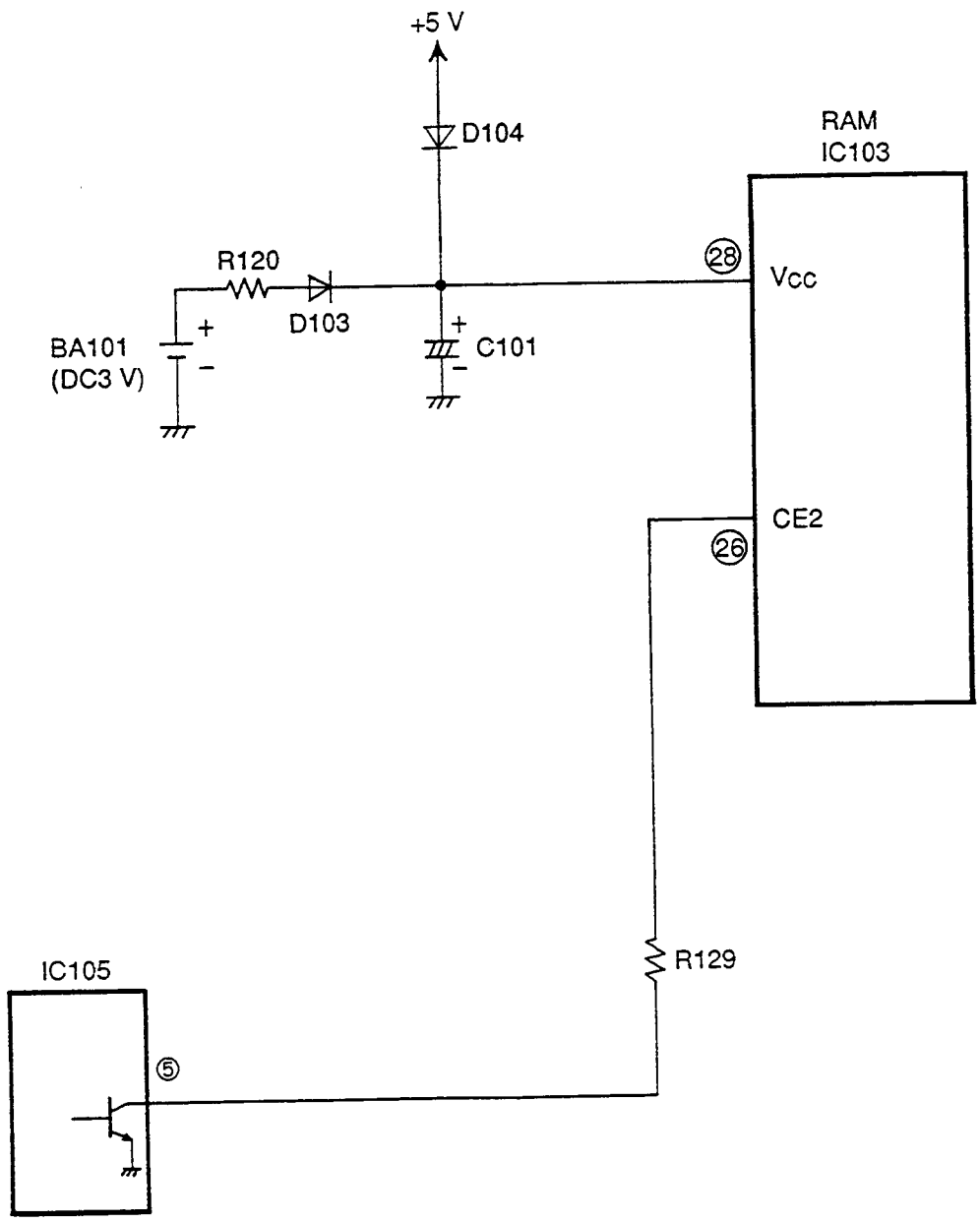


2-11. MEMORY BACKUP CIRCUIT

1) **Function**
This unit has a lithium battery, and this battery (BA101) is used for RAM (IC103) backup. The auto dial numbers, the transmission ID, settings, etc. are stored in the RAM (IC103).

2) **Circuit Operation**
When the power switch is ON, power is supplied from +5 V via D104 to pin 28 of the RAM (IC103), and at this time, the voltage at pin 28 of RAM (IC103) is about +5 V. When the power switch is OFF, power is supplied from BA101 via R120 and D103 to pin 28 of the RAM (IC103).
When +5 V goes down after +12 V, the reset IC105 operates, pin 5 of IC105 becomes low level, the internal transistor becomes ON, i.e. RAM (IC103) CE2=0 V occurs, and a backup mode with low current consumption (3 µA or less) is entered.

Circuit Diagram



2-12. ANALOG/DIGITAL CONVERTER (IC201)

1) Function

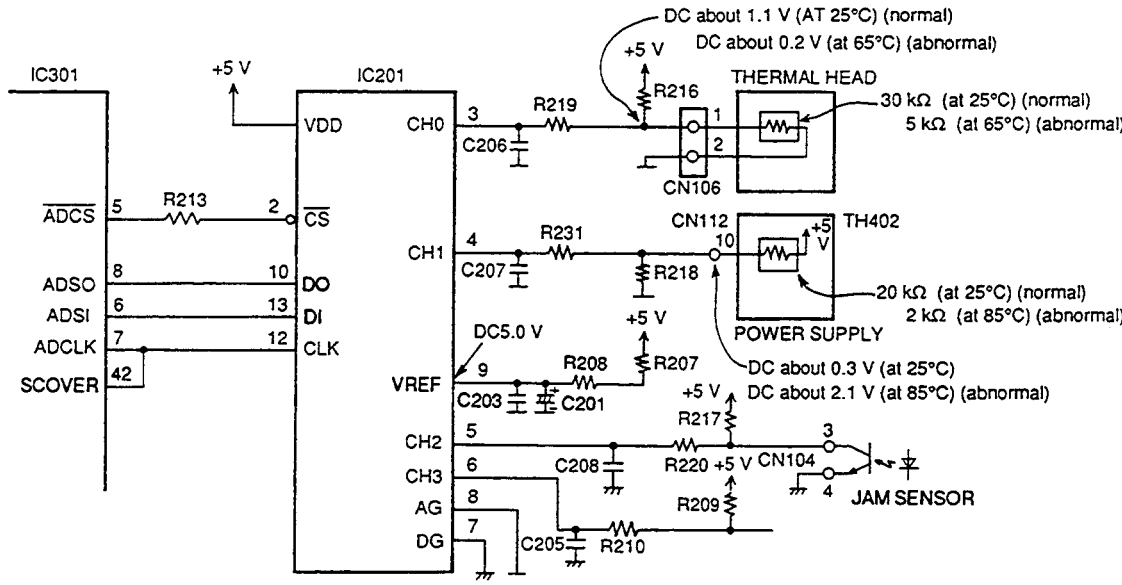
IC201 is used to monitor the resistance value of two thermistors and the voltage of the JAM sensor output signal, and comparing this to a reference signal.

The resistance value of the thermistor for power supply overheat detection, and resistance value of a thermistor for thermal head temperature detection and the voltage of the JAM sensor output signal are converted to digital data, and this information is sent to CPU.

(1) If the power supply unit becomes too hot (abnormal quantity of current flow out), alarm indicator lights to give warning, and remain on until the power supply unit cools.

(2) If the thermal head becomes too hot impression pulse width is set according to thermal head temperature so that there is no variation in print with temperature changes. At time of overheating, the same display is given as in the case of power supply unit, and will remain on until the unit cools.

Circuit Diagram



(3) The output from the JAM sensor is input to CH2.
The power is about 0 V when the JAM sensor senses the reflected light (condition of JAM).
It is about 2.7 V when the JAM sensor does not sense the reflected light (normal condition).

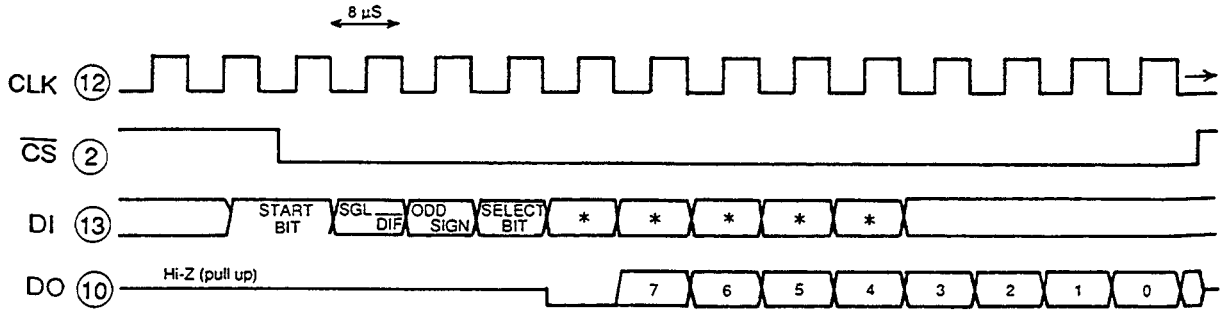
(4) CH3 is unused.

2) Circuit Operation

Voltages input to analog input terminals CH0, CH1 and CH2 (CH3 not yet used) and 1/256th increment voltage of VRF voltage (5 V) are compared constantly, converted to digital data and to serial data, and input to gate array IC301 (8) from DO. CPU (IC101) reads these values and performs corresponding processing. The timing chart is shown below.

Timing Chart

Timing during A/D conversion



Select Port	SGL/DIF	ODD/SIGN	SELECT BIT
CH0	I	O	O
CH1	I	I	O
CH2	I	O	I
CH3	I	I	I

I=High
O=Low

3. FACSIMILE SECTION

3-1. IMAGE DATA FLOW DURING FACSIMILE OPERATION

1) Copy

(C-1) The image data for one scan line is read by the CCD image sensor as analog signals. [(1) analog signal]

(C-2) The read CCD signal (1) is digitalized to white: 0, black: 1, by the digitalization circuit [(2) PIXDATA].

(C-3) The digitalized data are converted to 8 bit parallel data (3) and this data is written by DMA directly into RAM image buffer. (4)

(C-4) The data (5) read by DMA from the image buffer and passes through (6) for parallel to serial conversion, and then is sent as serial data (7) to the thermal head, which prints on the recording paper.

Copy Signal Path: (1)→(2)→(3)→(4) DMA→(5) DMA→(6)→(7)

2) Transmission

(T-1) Similar to copying, the (C-1, C-2, C-3) image data is read in the same way into the image buffer.

(T-2) The image buffer data is read out (5)→(9) by the CPU (IC101), and then converted to Modified Huffman code, and then written again into the communication buffer (8)→(4).

(T-3) During modem operation, the CPU (IC101) reads the data sequentially from the communication buffer (5→9), and transmits them to the modem (10).

(T-4) The modem (IC104) converts the digital data from the CPU (IC101) to serial analog data, and then transmitted to the telephone line via the NCU section.

Transmission Signal Path: (1)→(2)→(3)→(4) DMA→(5)→(9)→(8)→(4)→(5)→(9)→(10)→(12)

3)Reception

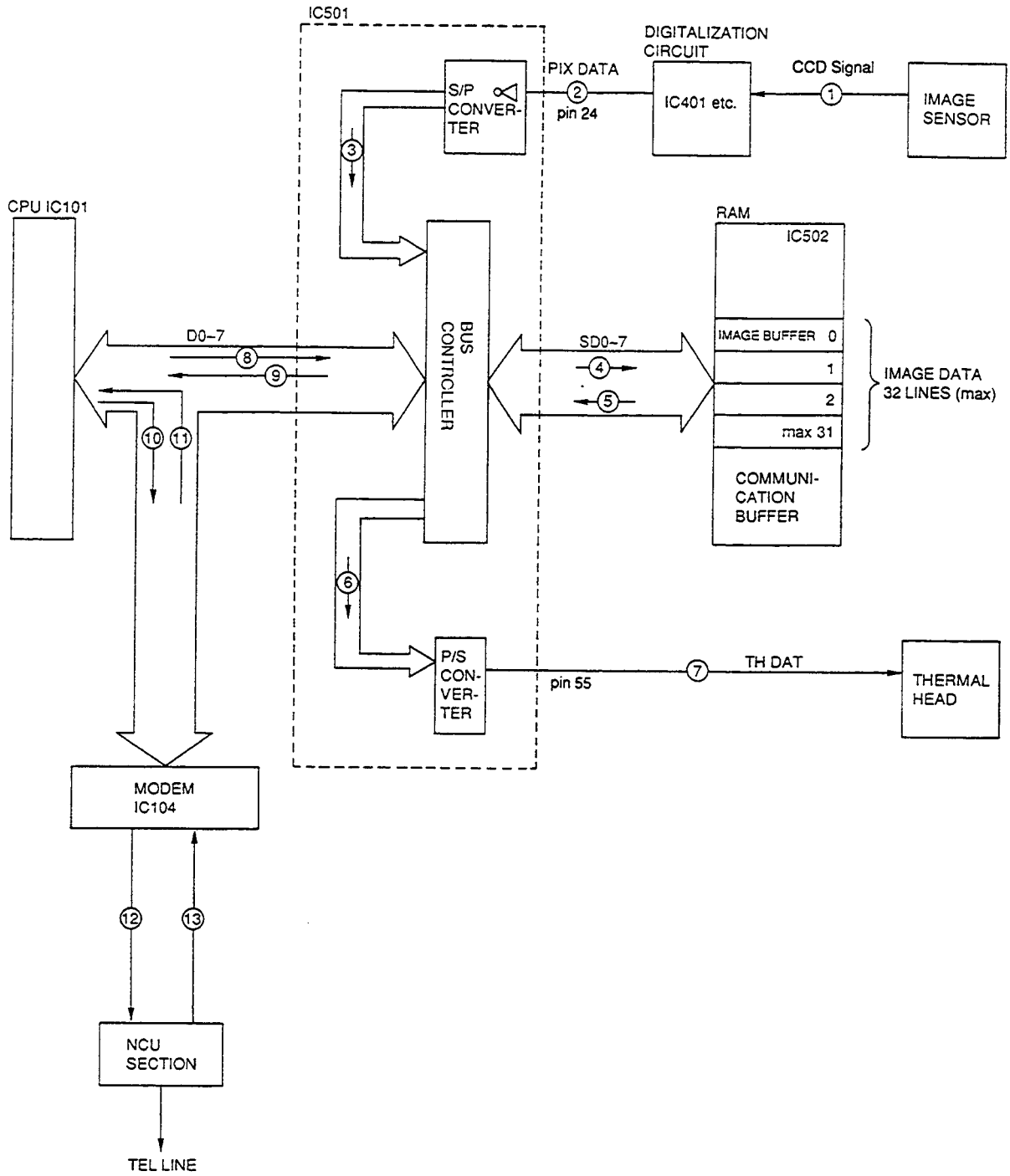
(R-1) The modem (IC104) receives the serial analog data (13). The data is converted to 8 bit parallel data by the modem (IC104) and read by the CPU (11), and then stored in the communication buffer in the RAM (IC502). (8)→(5)

(R-2) The CPU (IC101) reads the data in the communication buffer and decodes the Modified Huffman data to original data with 1728 bits per line, and writes into the image buffer. (5)→(9)→(8)→(4)

(R-3) The single line of image data written into the image buffer is read by DMA in the same way as copying, and after P/S conversion, it is transmitted to the thermal head for printing.

Reception Signal Path: (13)→(11)→(8)→(4)→(5)→(9)→(8)→(4)→(5)→(6)→(7)

Block Diagram

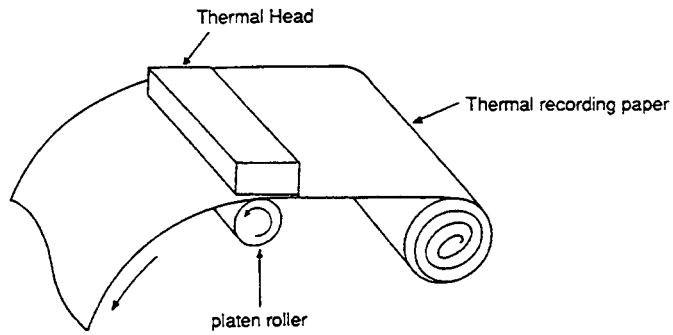


3-2. THERMAL HEAD

1) Function

This unit utilizes state of the thermal printer technology.
In this formation, the recording paper (roll paper) is chemically processed in advance. When the thermal head contacts this paper emits heat momentarily, black dots (appearing almost as a point) are printed on the paper. If this point is continued, letters and/or diagrams appear, and the original document is reproduced.

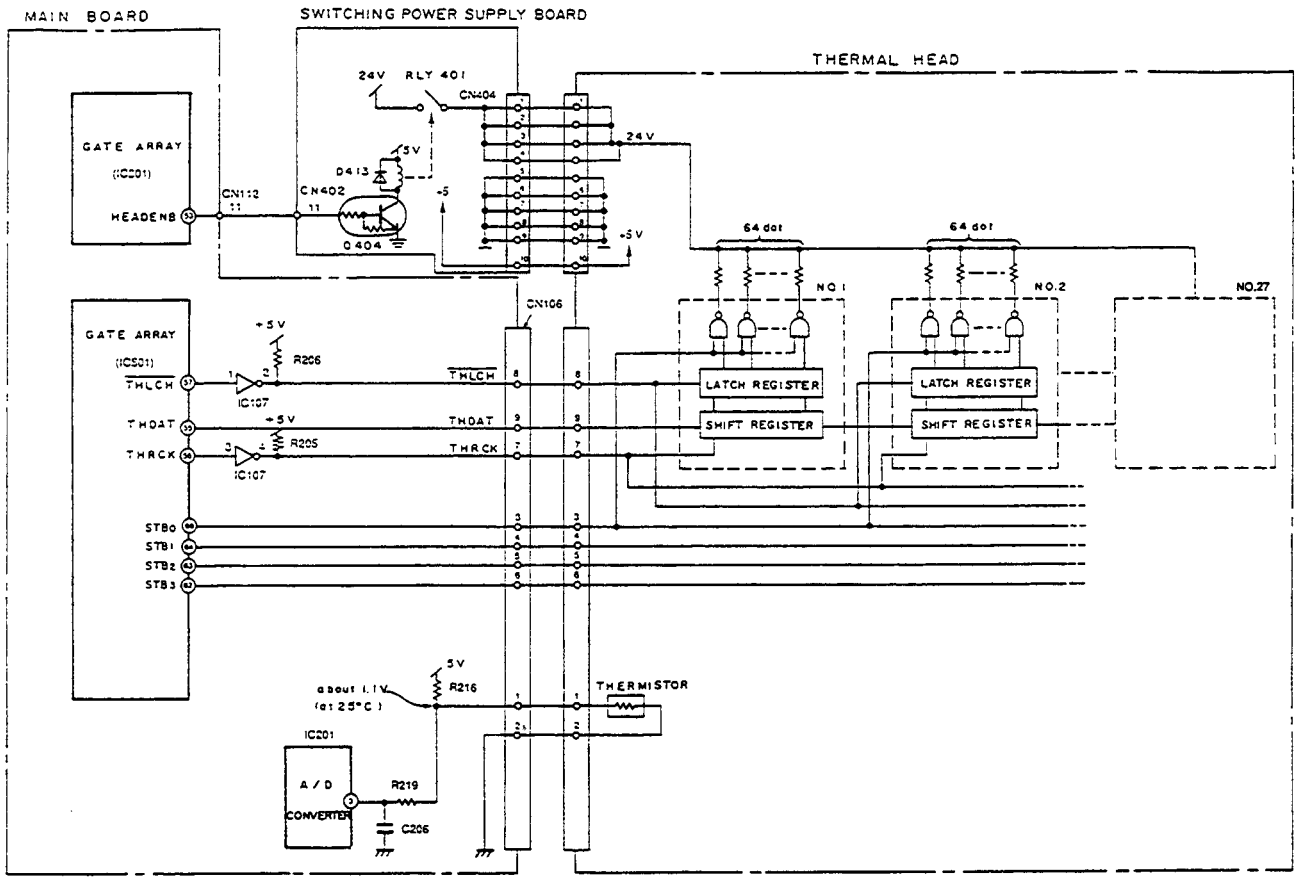
COMPOSITION OF THE RECEIVE RECORD SECTION (THERMAL RECORDING FORMAT)



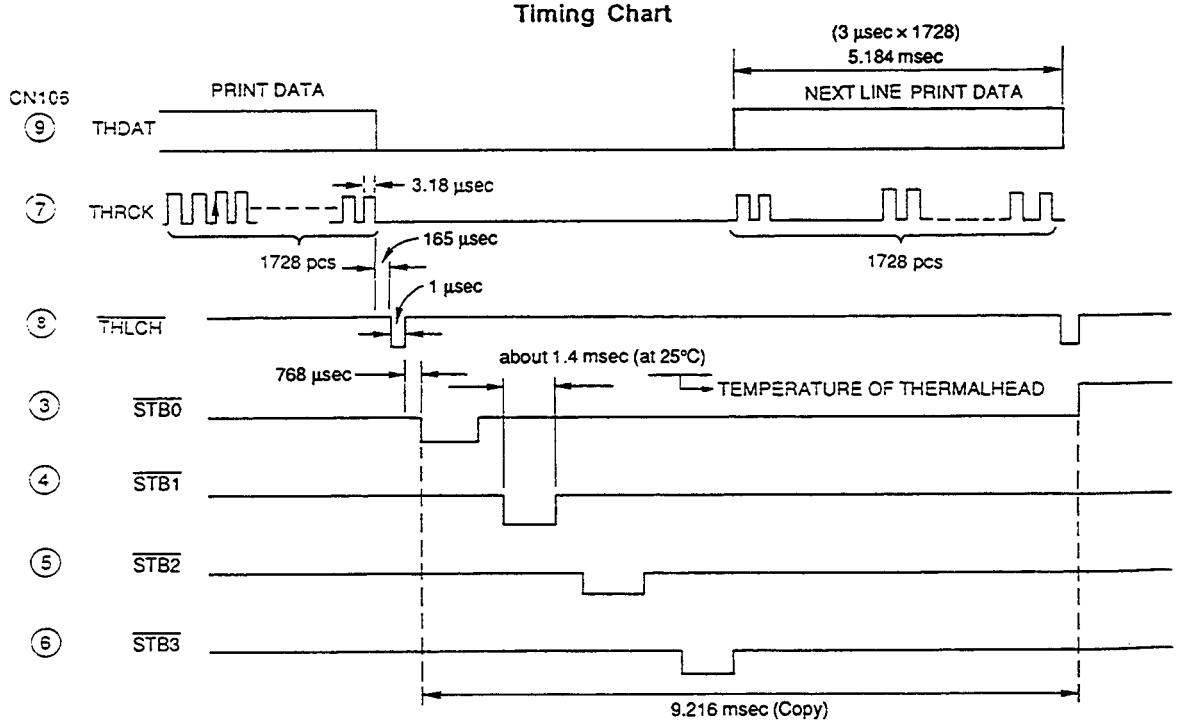
2) Circuit Operation

There are 27 driver ICs aligned horizontally on the thermal head and each one of these ICs can drive 64 heat emitting resistors. This means that one line is at a density of 64×27=1728 dots = (8 dots/mm).
White/Black (white = 0, black = 1) data in one line increments is synchronized at IC501 pin 56 ($\overline{\text{THRCK}}$) and sent from IC501 pin 55 (THDAT) to the shift register of the ICs. The shift registers of the 27 ICs are connected in series, and upon shift of 1728 dot increment, all the shift registers become filled with data, and a latch pulse is emitted to each IC from IC501 pin 57 (THLCH). With this latch pulse, all the contents of shift resisters are latched to the latch registers. Thereafter, through the addition of strobe from the IC501 pins (66, 64, 63, 62) only dot of location of black (=1) among latched data activates driver, and current passes to heat emitting body to cause heat emission.
Here the strobe of four lines STB0 to STB3 impresses at intervals of 9.22 msec., as required for one-line printout, for each 1/4th of 27 IC unit (3 unit or 4 unit) upon each time interval divided into four equal increments.
The sequence is as shown below. (Moreover, in the case of strobe width, the resistance value of the thermistor inside the thermal head is constantly detected by the A/D converter (IC201), and values from the ROM (IC102) table corresponding to temperatures eliminate temperature changes of density through setting by CPU (IC101).
When the thermal head is not used, the gate array IC301 (53, HEADENB) becomes low level, Q404 in the power supply unit becomes OFF, RLY401 breaks, and the +24 V power supply for the thermal head driver is not impressed to protect the IC.

Circuit Diagram



Timing Chart



3-3. READ SECTION

1) **Function**

- A document is illuminated by the LED array, and the reflections pass through the reduction-projection lens and are imaged on the CCD image sensor.
- The document image is photoelectrically transformed to analog image signal by the CCD image sensor, and the analog image signal corresponding to one line of the document is continuously output.
- The analog image signal enters the image signal processing circuit and then is converted into a black and white binary digital data array.

2) **Circuit Operation**

[Start]

When the START/COPY button is pushed, IC301 pin 4 becomes high level, Q402 and Q401 become ON, the voltage of CN103 pin 1 becomes about 24 V, and the voltage is applied to the LED array to turn on the LED.
Next, ØTG-N is output from IC501 pin 19. ØTG-N and Ø1-N, Ø2-N and ØR-N, which are regularly output, drive the image sensor.
The CCDSIG (the analog image signal) is output from the CCD board.

[Analog Signal Processing]

① Clamp

The CCDSIG that entered into the analog signal processing circuit via AC coupling circuit is cramped at 0 V by the analog switch (switch X of IC405).
The IC501 pin 26 signal (VIDRST) sets the timing of the clamping operation.

② Sampling

The image signal regenerated direct current in ① is amplified about three times by the amplifier (IC401).
The reset noises are removed from the image signal by the sample hold circuit (switch Y of IC405, C412 and IC401), and then the signal is sampled.
The IC501 pin 23 signal (S/H CLK) sets the timing of the sample hold operation.
The processed image signal (IC104 pin 7) is output to the peak hold circuit (See ④), AGC circuit (See ⑤) and comparator circuit (See ⑥).

③ Output compensation at the period of dark current

The output voltage during dark transmission (dummy picture element output), with the CCD dark current element, is taken as a sample by the sample hold circuit (switch Z of IC405, C414, IC402 and Q404). The IC501 pin 22 signal (BLCLK) sets the timing of the sample hold operation.
The Q404 emitter outputs the voltage of dark current period continuously. The output voltage is the standard low level voltage to be used for common voltage of the comparator circuit (See ⑥) so that the output voltage is compensated and canceled the dark current ingredient.

④ Peak Hold Circuit

The peak hold circuit consists of IC402, D403, R411, C413, R412 and IC404.
When the IC402 pin 3 input voltage becomes higher than the C413 voltage, D403 is conducted and the voltage at C413 becomes higher.
When the IC402 pin 3 input voltage becomes lower than the C413 voltage, D403 is cut off and C413 is gradually discharged via R412. The D404 cathode is the peak hold circuit output.

⑤ AGC Circuit

When the IC501 pin 25 signal (AGCE-N) is at low level, Q403 is cut off and the D402 cathode electric potential becomes the same as the one at IC401 pin 7. C401 is charged by this voltage. When the IC401 pin 7 electric potential becomes lower than that of C401, D402 is cut off and C401 is gradually discharged via R406. The constant value of C401 during the charge or discharge is higher than that of C413 so that C401 responds to relatively low frequencies.
IC403 pin 7 outputs a signal at AGC level (the peak value of the low frequencies).
The AGC level output is never lower than the voltage adjusted by the circuit, R409, R410, IC403 and D405.
R425 and R426 divide the AGC level output voltage, and then the comparator circuit compares the resulting values and that of the output voltage from the peak hold circuit and the highest value is used as the standard high level voltage for reference voltage gain.

⑥ Comparator Circuit

The difference of the standard voltages obtained in ③ and ⑤ is divided by the resistors in comparator circuit to make reference voltage.

When the IC301 pin 1 signal (DARK) becomes high level, the voltage is divided by R413, 415 and R429. When the signal becomes low level, the voltage is divided by R413, R414 and R428.

IC406 is the comparator circuit and functions as follows:

- Pin 6 voltage>pin 7 voltage then pin 1 becomes low level.
- Pin 5 voltage<pin 4 voltage then pin 2 becomes low level.
- Pin 7 voltage>pin 11 voltage>pin 4 voltage and the pin 10 voltage>pin 11 voltage then pin 13 becomes low level.

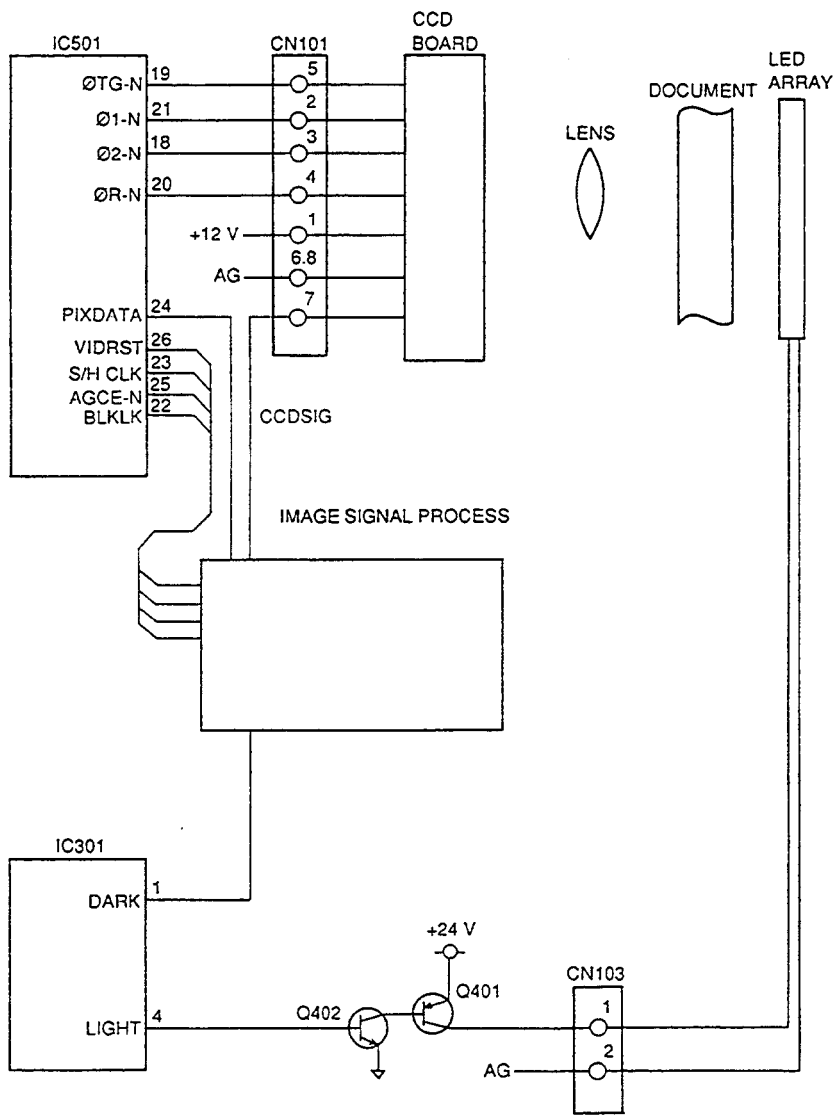
Here, when at least one of the outputs from pin 2 and 13 of IC406 becomes low level, the IC107 pin 2 signal becomes high level (black data). And when at least one of the outputs from IC406 pin 1 and IC107 pin 2 becomes low level, the image signal processing circuit output (PIX DATA) becomes low level.

In brief, when the voltage of the image signal is higher than that of IC406 pin 7, the PIX DATA becomes low level and the data appears in white.

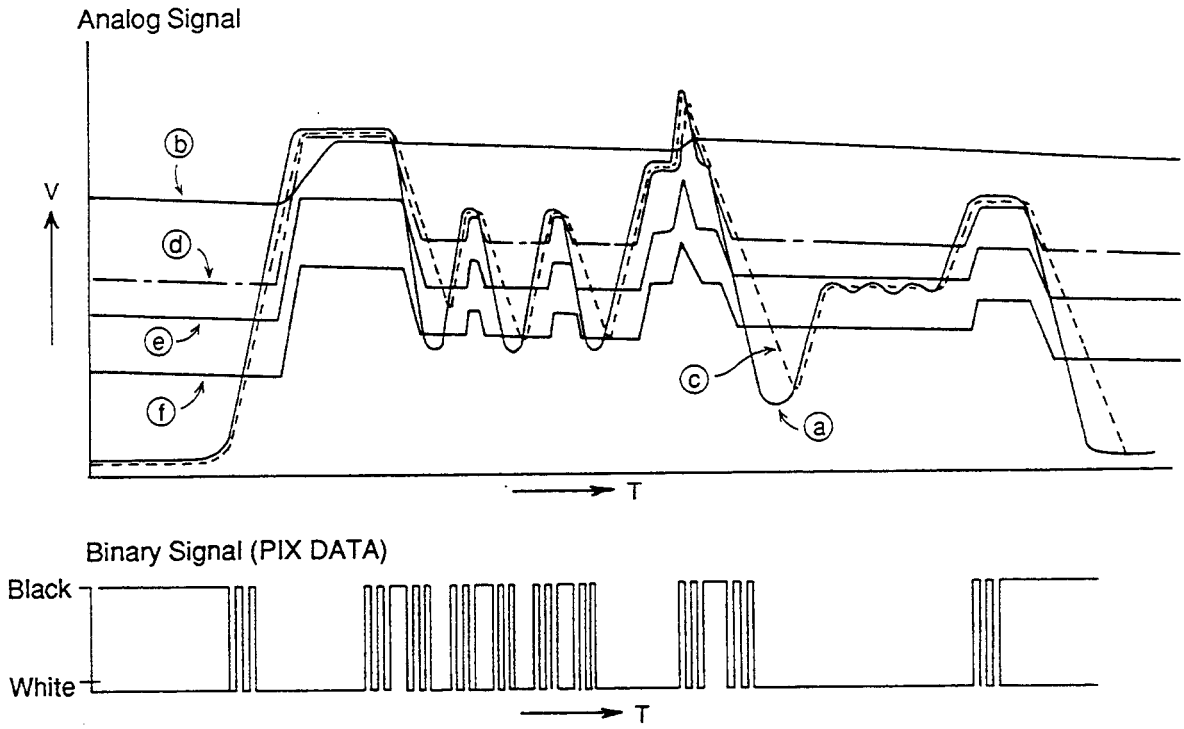
When the voltage on the image signal is lower than that of IC406 pin 4, the PIX DATA becomes high level and the data appears in black.

When the voltage of the image signal is between those of IC406 pin 7 and pin 4, IC406 pin 13 outputs a high level and low level signal alternately and the data appears like half tones because the signal whose high frequency was lowered by R416 and C416 and the original signals, including high frequency ones, are compared by the comparator circuit.

Block Diagram

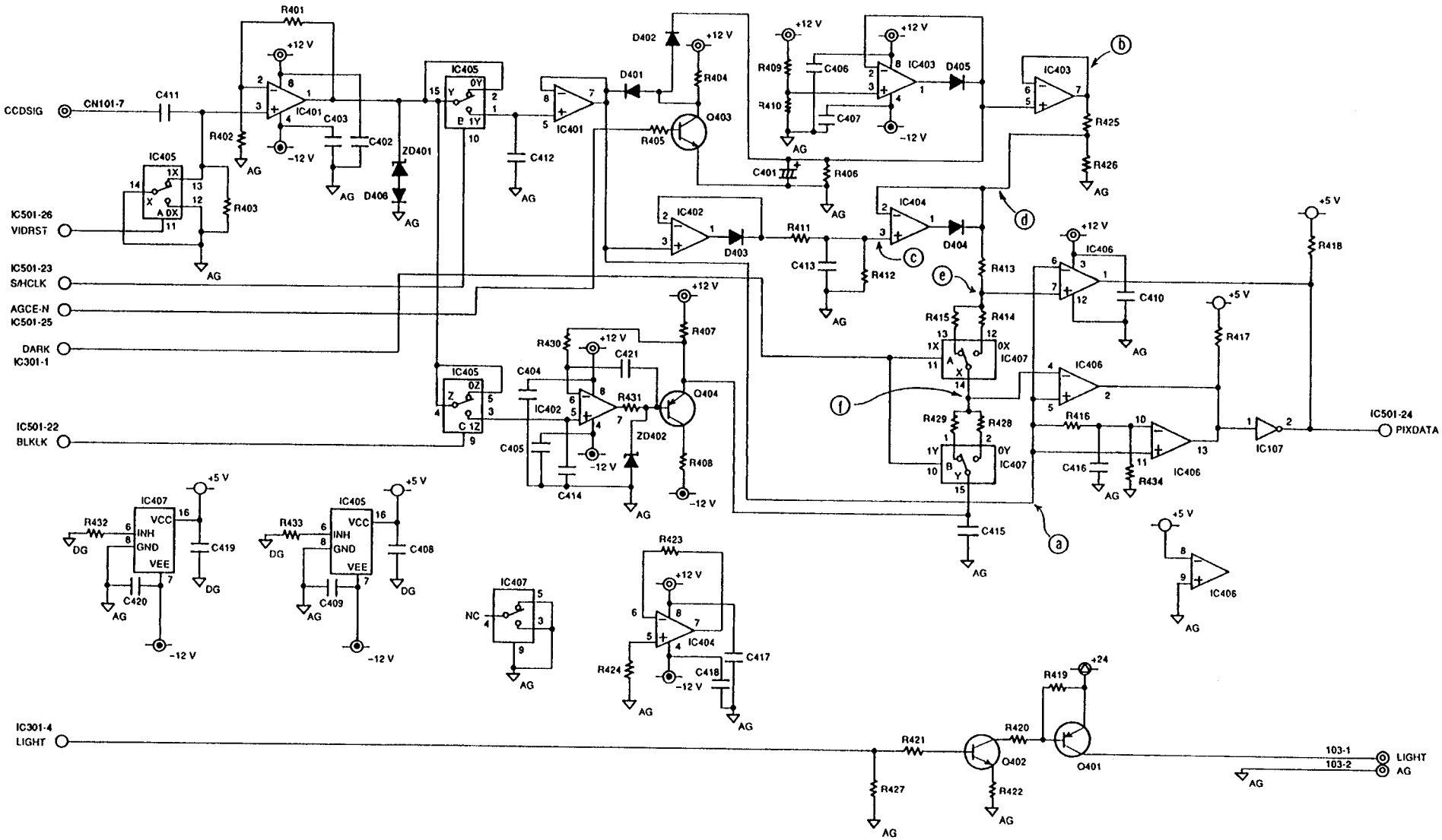


ANALOG AND BINARY SIGNALS



ⓐ ~ ⓕin the figure are the wave forms of those in the circuit diagram.

Circuit Diagram



3-4. STEPPING MOTOR DRIVE CIRCUIT

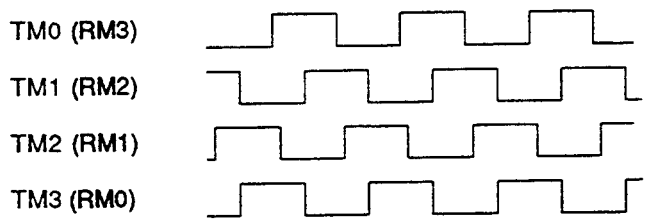
1) Function

Two individual stepping motors are used for transmission and reception. They feed document or recording paper synchronized for reading or printing.

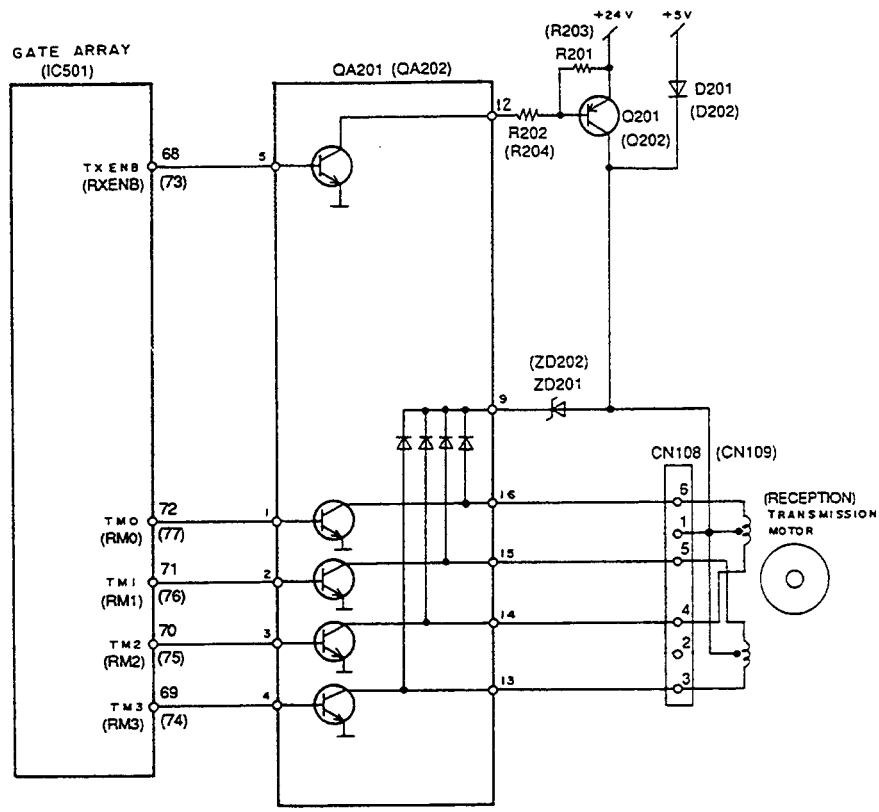
2) Circuit Operation

During motor drive, gate array IC501 pin 68/pin 73 becomes high level, pin 12 of driver QA201/QA202 becomes low level, and Q201/Q202 go ON as a result, +24 V is supplied to the motor coil.
Stepping pulses are output from gate array IC501, causing driver QA201/QA202 to go ON.
The motor coil is energized sequentially in 2 phase increments, which causes a 1-step rotation. Rotation of 1-step feeds 0.13mm of recording paper or document paper.
Timing chart is below.

Timing Chart



Circuit Diagram



When the motor is OFF, gate array IC501 pin 68/pin 73 becomes low level and pin 12 of driver QA201/QA202 becomes high level. This causes Q201/Q202 to also go OFF, and instead of +24 V, +5 V is supplied through D201/D202 so that the motor is held in place.

3-5. DOCUMENT AND RECORDING PAPER FEED MECHANISM SECTION AND SENSOR SECTION

1) Document and Recording Paper Feed Mechanism

[Document Path]

- When the document is aligned in the center, the maximum document width is 218 mm.
- The separation roller (2) and feed rollers (3), (4), (5) are driven by the stepping motor via gears, and rotate in the direction of the arrows as shown in the figure.

The paper feed sequence is described below.

(1) Insert the document along the document insertion guide on the tray. When the documents are placed into position, the document sensor (7) is turned on and a beep will sound so that the user knows the document is properly set.

(2) When the START button is pressed, the motor starts and the rollers start rotating.

(3) One sheet at a time is separated by the separation rubber (6) then sent to the separation roller (2) which rotates and then feeds the document into the unit. (Automated feeding operation)

(4) The read position sensor (8) is turned on when the document is fed.

(5) The document is fed to the CCD start reading position according to the ON data of the read position sensor (8).

(6) When the document reaches the CCD start reading position, the CCD starts reading.

(7) The document is fed when the document feeding and CCD reading are synchronized.

(8) When the document is completely fed and the read position sensor (8) is turned off, the CCD stops reading and the document is discharged by the feed roller (5).

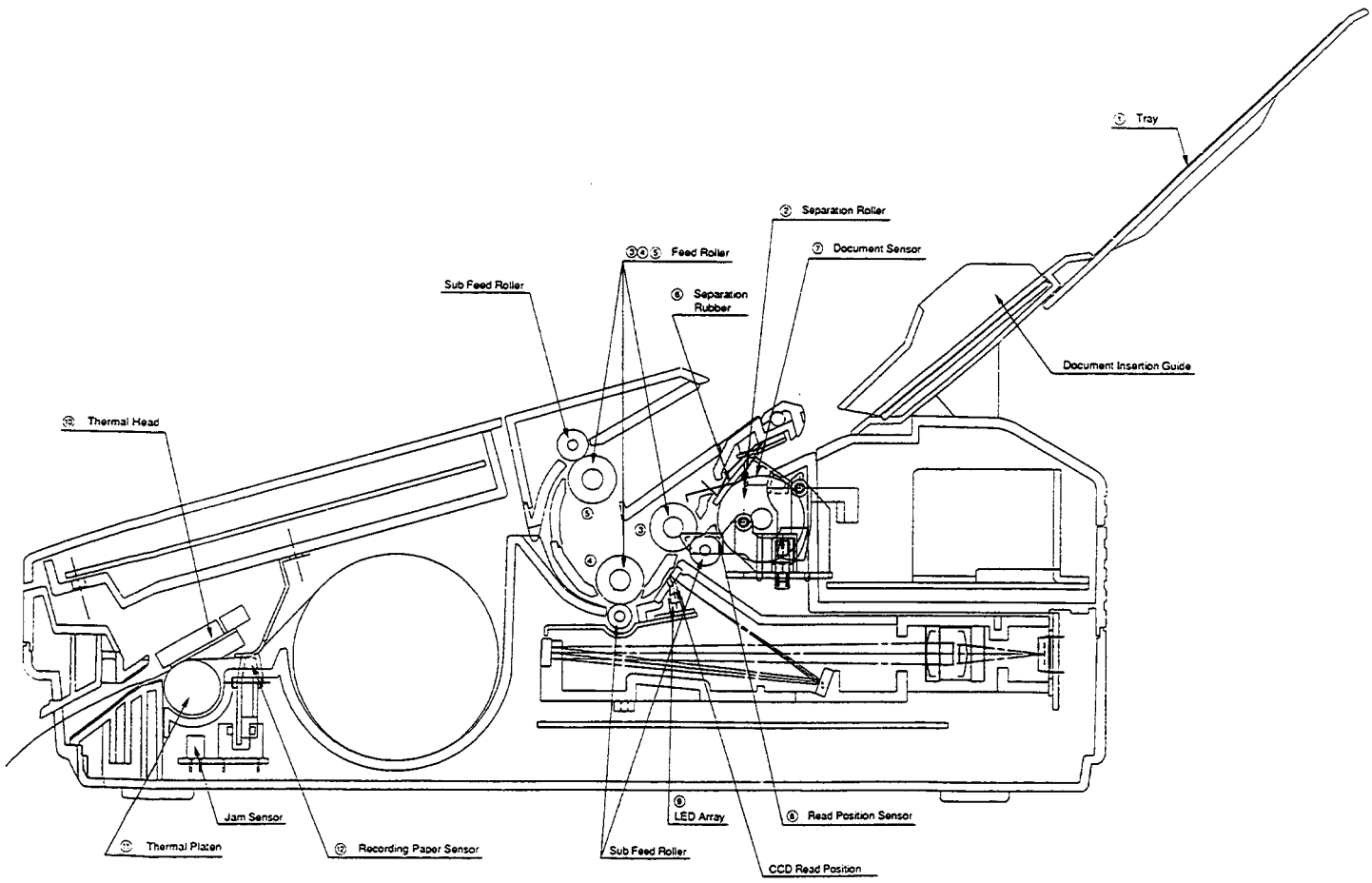
(9) The next sheet separated by the separation roller is fed in.

[Recording Paper Path]

(1) The recording paper is set between the thermal head and thermal platen.

(2) When the signal is sent to the thermal head, printing on the thermosensible recording paper is started.

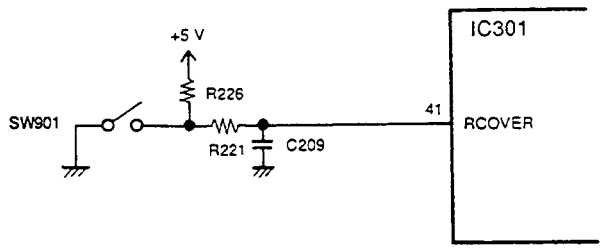
(3) When the recording paper runs out, the recording paper sensor (12) is turned off so as to warn the user.



2) Sensor

[Cover Open Switch (SW901)]
When the upper cabinet is closed, the lever of S901 is pushed and the switch becomes ON.

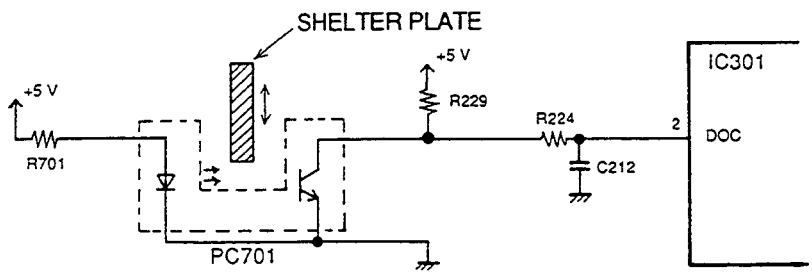
Circuit Diagram



	S901	Signal(IC301-41 pin)
Open	ON	Low Level
Close	OFF	High Level

[Document Sensor (PC701)]
When an document is set, the shelter plate shuts the sensor light, the phototransistor becomes OFF, and the input signal of IC301 pin (2) becomes high level.
When there is no document, the shelter plate passes the sensor light, the phototransistor becomes ON, and the input signal of IC301 pin (2) becomes low level.

Circuit Diagram

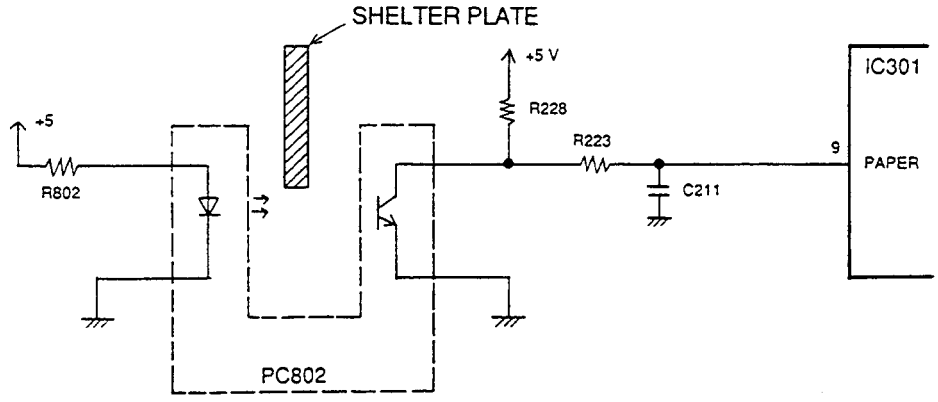


Document	Phototransistor	Signal (IC301-2 pin)
Set Document	OFF	High Signal
No Document	ON	Low Level

[Recording Paper Sensor (PC802)]

When recording paper is present, the recording paper pushes against one side of the shelter plate, so that the shelter plate shuts the light. Then the phototransistor becomes OFF and the signal of IC301 pin (9) becomes high level.
When the set runs out of recording paper, the shelter plate no longer will be pushed, so that the spring force brings it to the position where the light is passed. Then the phototransistor becomes ON and the signal of IC301 pin (9) becomes low level.

Circuit Diagram

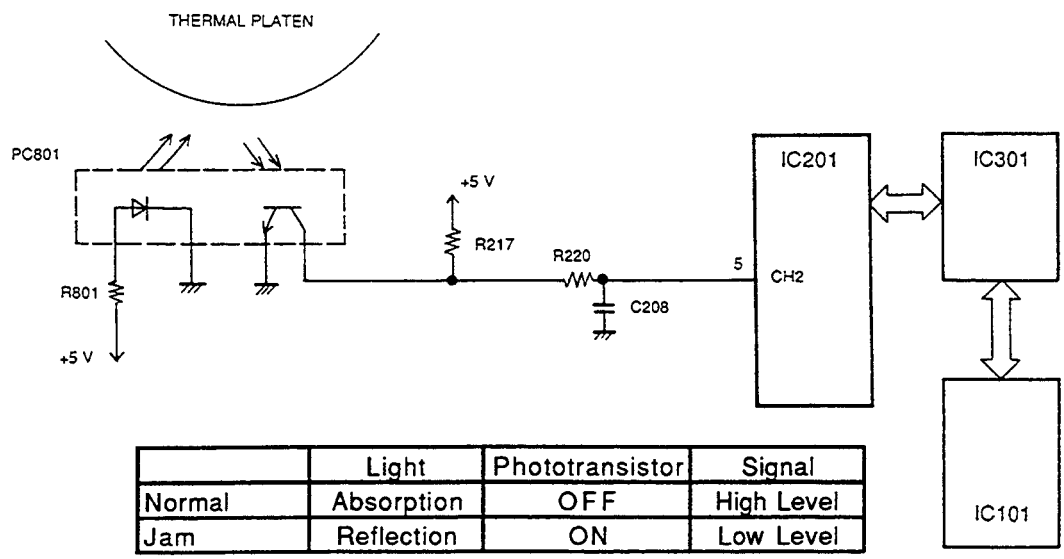


	Light	Phototransistor	Signal
Set Recording Paper	Shut	OFF	High Level
No Recording Paper	Pass	ON	Low Level

[Jam Sensor (PC801)]

A reflector-type photosensor is used. Normally, the light from the photodiode hits the thermal platen, but as there is no reflection, the phototransistor becomes OFF and the signal of IC201 pin (5) becomes high level.
IC201 is an A/D converter, controlled by IC101/IC301. (See A/D converter section)
When the recording paper has caused a jam by becoming wrapped around the platen, the phototransistor becomes ON and the signal of IC201 pin (5) becomes low level.

Circuit Diagram



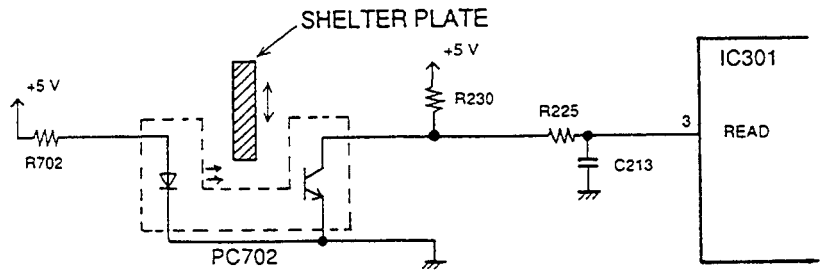
	Light	Phototransistor	Signal
Normal	Absorption	OFF	High Level
Jam	Reflection	ON	Low Level

[Read Position Sensor (PC702)]

When an document is brought to the read position, the shelter plate shuts the sensor light, the phototransistor becomes OFF, and the input signal of IC301 pin (3) becomes high level.

When there is no document at the read position, the shelter plate passes the sensor light, the phototransistor becomes ON, and the input signal of IC301 pin (3) becomes low level.

Circuit Diagram



Document	Phototransistor	Signal
At the Read Position	OFF	High Signal
Out of the Read Position	ON	Low Level

4. MODEM SECTION

4-1. FUNCTION

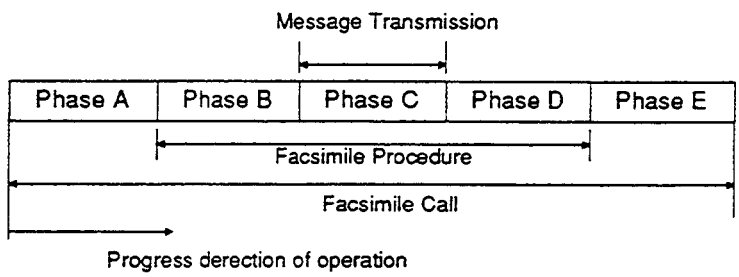
The unit uses a 1 chip modem (IC104), enabling it to act as an interface between the control section for FAX sending and receiving, and the telephone line. During a sending operation, the digital image signals are modulated and sent to the telephone line, while during a receiving operation, the analog image signals which are received via the telephone line are demodulated and converted into digital image signals. The communication format and procedures for FAX communication are standardized by CCITT. This 1 chip modem (IC104) has hardware which sends and detects all of the necessary signals for FAX communication.
It can be controlled by writing commands from the CPU (IC101) to the register in the modem (IC104).
This modem (IC104) also sends DTMF signals, generates a call tone (from the speaker), and detects a busy tone and dial tones.

Overview of Facsimile Communication Procedures (CCITT Recommendation):

1) **ON CCITT** (International Telegraph and Telephone Consultative Committee)
The No. XIV Group of CCITT, one of the four permanent organizations of the International Telecommunications Union (ITU), investigates and make recommendations on international standards for facsimile.

2) **Definition of Each Group**
- Group I (G1)
A-4 size documents official without using formats which reduce the band width of signals sent over telephone lines.
Determined in 1968.
Transmission for about 6 minutes at scanning line density of 3.85 lines/mm.
- Group II (G2)
Using reduction technology in the modulation/demodulation format, A-4 size document is sent at an official scanning line density of 3.85 lines/mm for about 3 minutes.
Methods to suppress redundancy are not used.
Determined in 1976.
- Group III (G3)
Method of suppressing redundancy in the image signal prior to modulation is used. A-4 size document is sent within about one minute.
Determined in 1980.
- Group N (G4)
Transmission is via data network. Method is provided for suppressing redundancy in signals prior to transmission, and error-free reception of transmission is possible.
The scope of these facsimile applications is not limited simply to transmission of written statements. Through symbiotic linkages with other communications methods, it can be expected to expand to include integrated services.

3) **Facsimile Call Time Series**
As shown in the following diagram, the facsimile call time series is divided into five phases.



Phase A: Call setting
Call setting can be manual/automatic.
Phase B: Pre-message procedure
Phase B is a pre-processing procedure and a sequence for confirming status of terminal, transmission route, etc. and for terminal control. It implements terminal preparation status, determines and displays terminal constants, confirms synchronization status, etc. and prepares for transmission of facsimile messages.
Phase C: Message transmission
Phase C is the procedure for transmission of facsimile messages.
Phase D: Post message procedure
Phase D is the procedure for confirming that the message is completed and received. In the case of continuous transmission, return is made repeatedly to phase B or phase C for transmission.
Phase E: Call retrieval
Phase E is the procedure for call retrieval, that is, for circuit disconnection.

4) **Concerning Transmission of Time**

Transmission Time = Control Time + Image Transmission Time + Hold Time

Transmission time consists of the following.

Control time: This is time at the start of transmission when functions at the sending and receiving sides are confirmed, transmission mode is established, and transmission and reception are synchronized.

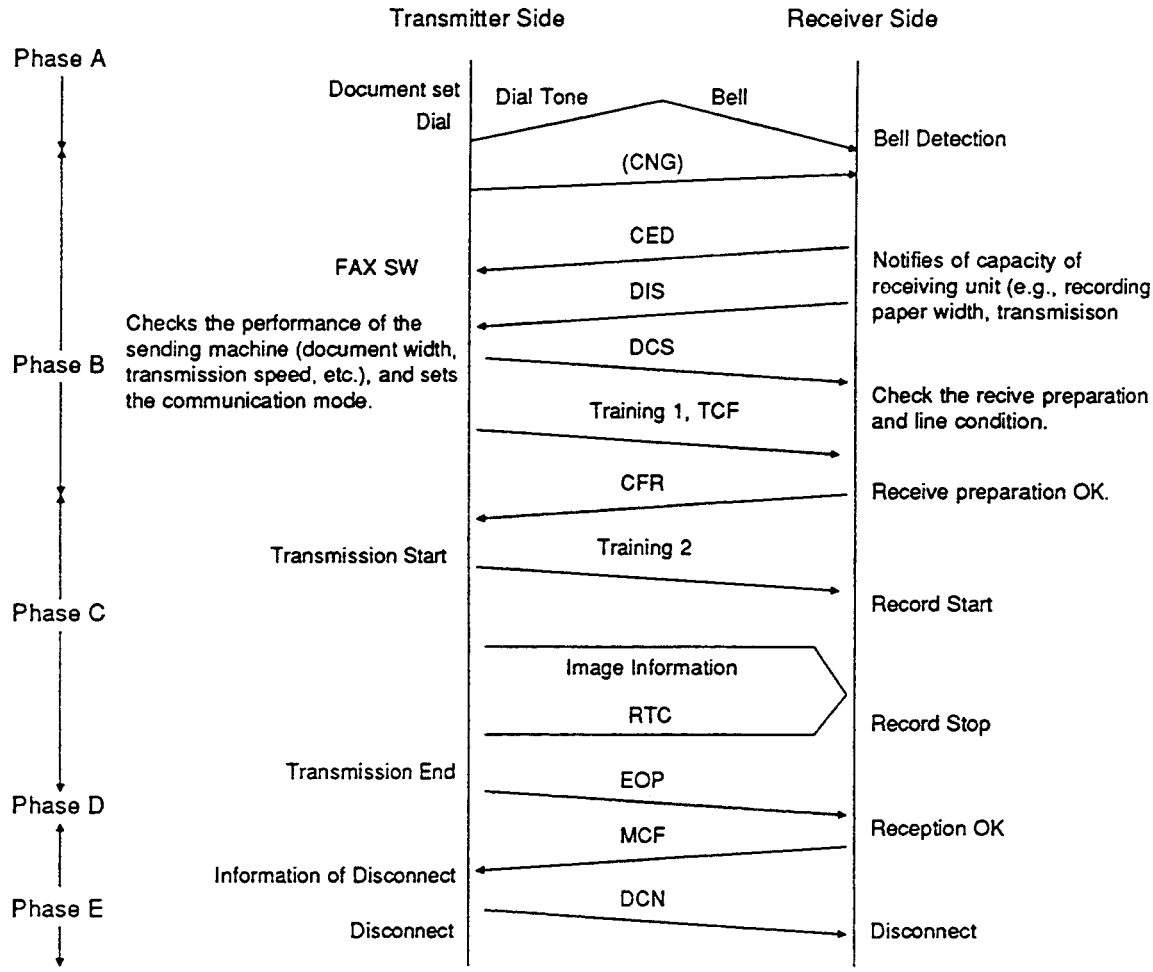
Image transmission time:
This is the time required for transmission of document contents (image data). in general, this time is recorded in the catalog, etc.

Hold time: This is the time required after the document contents have been sent to confirm that the document was in fact sent, and to check for telephone reservations and/or the existence of continuous transmission.

5) **Facsimile Standard**

Item	Telephone Network Facimile G3 Machine
Connection Control Mode	Telephone Network Signal Mode
Terminal Control Mode	T.30 Binary
Facsimile Signal Format	Digital
Modulation Mode	PSK (V.27 ter) or QAM (V.29)
Transmission Speed	300 bps (Control Signal) 2400, 4800, 7200, 9600 bps (FAX Signal)
Redundancy Compression Process (Coding Mode)	1 dimension : MH Mode
Resolution	Main Scan : 8 pel/mm Sub Scan : 3.85, 7.7l/mm
Line Synchronization Signal	EOL Signal
1 Line Transmission Time [ms/line]	Depends of degree of data reduction. Minimum Value : 10, 20. Can be recognized in 40ms.

(1) G3 Communication Signals (T. 30 Binary Process)
In G3 facsimile communication, this is the procedure for exchange of control signals between the sending and receiving machines both before and after transception of image signals.
Control signals at 300 bps FSK are: 1850Hz ... 0, 1650Hz ... L.
An example of binary process in G3 communication is shown below.



Explanation of Signals
Control signals are comprised mainly of 8-bit identification signals and the data signals added to them. Data signals are added to DIS and DCS signals.

Signal .....DIS (Digital Identification Signal)

Identification Signal Format 00000001

Function:
Notifies of capacity of receiving unit.
The added data signals are as follows.

(Example)

Bit No.	Function	Standard Setting DIS	Remarks
1 ~ 8	Not Used (Fixed)	0	
9	Transmission Function (T4)	0	
10	Reception Function (T4)	1	
11	Modulation Mode and	×	11: 0, 12: 1 — 4800~2400b/s; 11: 1, 12: 1 — 9600~2400b/s
12	Data Speed	1	
13~14	Not Used (fixed)	0	
15	Sub. Scan Line Density 7.7 L/mm	1	0: 3.85 L/mm 1: 3.85, 7.7 L/mm
16	Two-dimensional Coding Function	0	0: MH 1: MH, MR
17	Max. Paper Width: B4	0	
18	Max. Paper width: A3	0	
19	Max. Paper Length: B4	0	
20	Paper Length Unlimited	1	
21	1 Line Min. Scan Time	×	21: 1, 22: 1, 23: 0 — 20 msec (3.85 line/mm)
22		×	
23		×	10 msec (7.7 line/mm)
24	Extension Field	1	
25~32	Not Used (Fixed)	0	

Signal ..... DCS (Digital Command Signal)

Identification Signal Format X1000001

Function:
Notes capacity of receiving machine obtained at DCS and announces the transmission mode of the sender.
The added data signals are as follows.

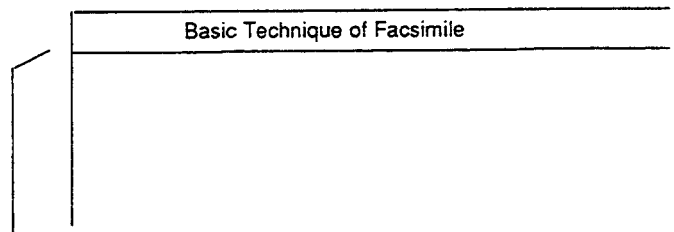
(Example)

Bit No.	Function	Standard Setting DCS	Remarks
1 ~ 8	Not Used (Fixed)	0	
9		0	
10	Reception Command (T4)	1	
11	Modulation Mode and	×	11: 0, 12: 0 — 2400b/s V27ter 11: 0, 12: 1 — 4800b/s V27ter 11: 1, 12: 0 — 9600b/s V29 11: 1, 12: 1 — 7200b/s V29
12	Data Speed	×	
13~14	Not Used (fixed)	0	
15	Sub. Scan Line Density 7.7 L/mm	×	1 : 7.7 L/mm 0 : 3.85 L/mm
16	Two-dimensional Coding Function	0	
17	Max. Paper Width: B4	0	
18	Max. Paper width: A3	0	
19	Max. Paper Length: B4	0	
20	Paper Length Unlimited	×	Reception Unlimited: 1
21	1 Line Min. Scan Time	0	21: 0, 22: 0, 23: 0 — 20 msec 21: 0, 22: 0, 23: 1 — 40 msec 21: 0, 22: 1, 23: 0 — 10 msec 21: 1, 22: 0, 23: 0 — 5 msec 21: 1, 22: 1, 23: 1 — 0 msec
22		×	
23		×	
24	Extension Field	1	
25~32	Not Used (Fixed)	0	

Signal	Identification Signal Format	Function
Training 1	————	Fixed pattern is transmitted to receiving side at speed (2400 to 9600 bps) designated by DCS, and the receiving side optimizes the automatic equlizer, etc., according to this signal.
TCF (Training Check)	————	Sends 0 continuously for 1.5 seconds at the same speed as the training signal.
CFR (Confirmation to Receive)	X0100001	Notifies sending side that TCF has been properly received. If TCF is not properly received, FTT (Failure To Train) X0100010 is relayed to sender. Sender then reduces transmission speed by one stage and initiates training once again.
Training 2	————	Used for reonfirmation of receiving side the same as training 1.
Image Signal	Refer to next page.	————
RTC (Return to Control)	————	Sends 12 bit (0 ... 01 x 6 times to receiver at same speed as image signal and notifies of completion of transmission of first sheet.
EOP (End of Procedure)	X1110100	End of one communication
MCF (Message Confirmation)	X0110001	End of 1 page receive.
DCN (Disconnect)	X1011111	Phase E start
MPS (Multi-Page Signal)	X1110010	Completion of transmission of 1 page. If there are still more documents to be sent, they are output instead of EOP. After MCF reception, sender transmits image signal of seconds sheet.
PRI-EOP (Procedure Interrupt-EOP)	X1111100	If there is an operator call from the sender, it is output after RTC.
PIP (rocedural Interrupt Positive)	X0110101	Output in the case of operator call from receiver.

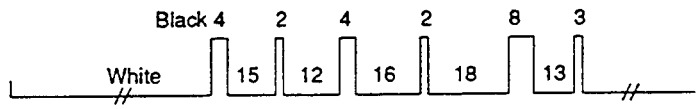
2) Redundancy Compression Process Coding Mode
This set uses one-dimensional MH format.

(a) Document



(b) Part of document

(c) Run length and image signals equivalent to (b)



(c) Codification of (c) according to MH formula

00110111101010	011	110101	11	001000	011	101010
(White 400)	(Black 4)	(White 15)	(Black 2)	(White 12)	(Black 4)	(White 16)

11	0100111	000101	000011	10
(Black 2)	(White 18)	(Black 8)	(White 13)	(Black 3)

(c) Total bit number before codification (497 bit)
(d) Total bit number after MH codification (63 bit)

Modified Huffman (MH) Code		
Run length	Code for White Line	Code for Black Line
0	00110101	000011011
1	000111	010
2	0111	11
3	1000	10
4	1011	011
5	1100	0011
6	1110	0010
7	1111	00011
8	10011	000101
9	10100	000100
10	00111	0000100
11	01000	0000101
12	001000	0000111
13	000011	00000100
14	110100	00000111
15	110101	000011000
16	101010	0000010111
17	101011	0000011000
18	0100111	0000001000

4-2. MODEM CIRCUIT OPERATION

The modem (IC104) has all the hardware satisfying the CCITT standards mentioned previously.
When the gate array IC501 (79) is brought to low level, the modem (IC104) is chip-selected and registers inside IC are selected by select signals from CPU (IC101) A0-A4, commands are written through data bus, and all processing is controlled at the CPU (IC101) according to CCITT procedures. Here the signal $\overline{INT}$ dispatched from $\overline{IRQ}$ (pin 58 of IC104) to the CPU (IC101) and gate array IC501 is output when preparation for acceptance of transmission data is OK and when demodulation of reception data is complete; the CPU (IC101) implements post processing.
This modem (IC104) has an automatic application equalizer. With training signal 1 or 2 at time of G3 reception, it can automatically establish the optimum equalizer. With CABLE1 and CABLE2, the equalizer in the modem (IC104) can be set up from outside. When the distance to the station is long or transception does not occur properly, correction of 0.0km, 1.8Km, 3.6Km and 7.2Km is possible with user setting. (See port description of gate array IC501.)
Also, the modem (IC104) generates an internal clock of 24.00014MHz by means of an external crystal oscillator (X101), and a 6MHz clock is output at pin 9 by internal frequency division. This clock enters at pin 14 of the gate array (IC501), directly, and pin 6 of CPU (IC101) via IC303, further frequency division is executed in the gate array (IC501), and an 2 MHz clock is output at pin 28 as the basic clock for gate array IC301. The functions of the modem (IC104) and the signal path are shown below.

1) Facsimile Transmission
The digital image data on the data bus is modulated in the modem (IC104), and sent from pin 28 via amplifier IC106 (2→1), the NCU section to the telephone line.

IC104(28)→R104→IC106(2)(1)→C69→R65→NCU Section[IC10(3)(4)→R40→C21→IC4(6)(7)→R32→T1]→TEL. Line

2) Facsimile Reception
The analog image data which is received from the telephone line passes through the NCU section and enters pin 37 of the modem (IC104). The signals that enter pin 37 of the modem (IC104) are demodulated in the board to digital image signals, then placed on the data bus.
In this case, the image signals from the telephone line are transmitted serially, Hence they are placed on the bus in 8bit units. Here, internal the equalizer circuit reduces the image signals to the long-distance receiving level.
It is designed to correct the characteristics of the frequency band centered about 3kHz and maintain a constant receiving sensitivity. It can be set in the service mode.

TEL. Line→NCU Section [T1→R31→C16→IC13(2)(1)→IC10(14)(13)]→C68→R106→IC106(6)(7)→R107→IC104(37)

3) DTMF Transmission (Monitor tone) and Line send Beep (for ATAS)
The DTMF signal generated in the modem (IC104) is output from pin 28, then passes through the analog switch IC9 pins (3-4), and the NCU section to the telephone line.
During monitor operation, the monitor tone is output through the analog switch IC9 pins (1-2), the ATAS IC11 pins (6-3) (power amplifier) to the speaker.

(DTMF and Beep Line Send)
IC104(28)→R104→IC106(2)(1)→C62→IC9(3)(4)→C58→R68→NCU Section [IC10(5)(4)→R40→C21→IC4(6)(7)→R32→TEL. Line

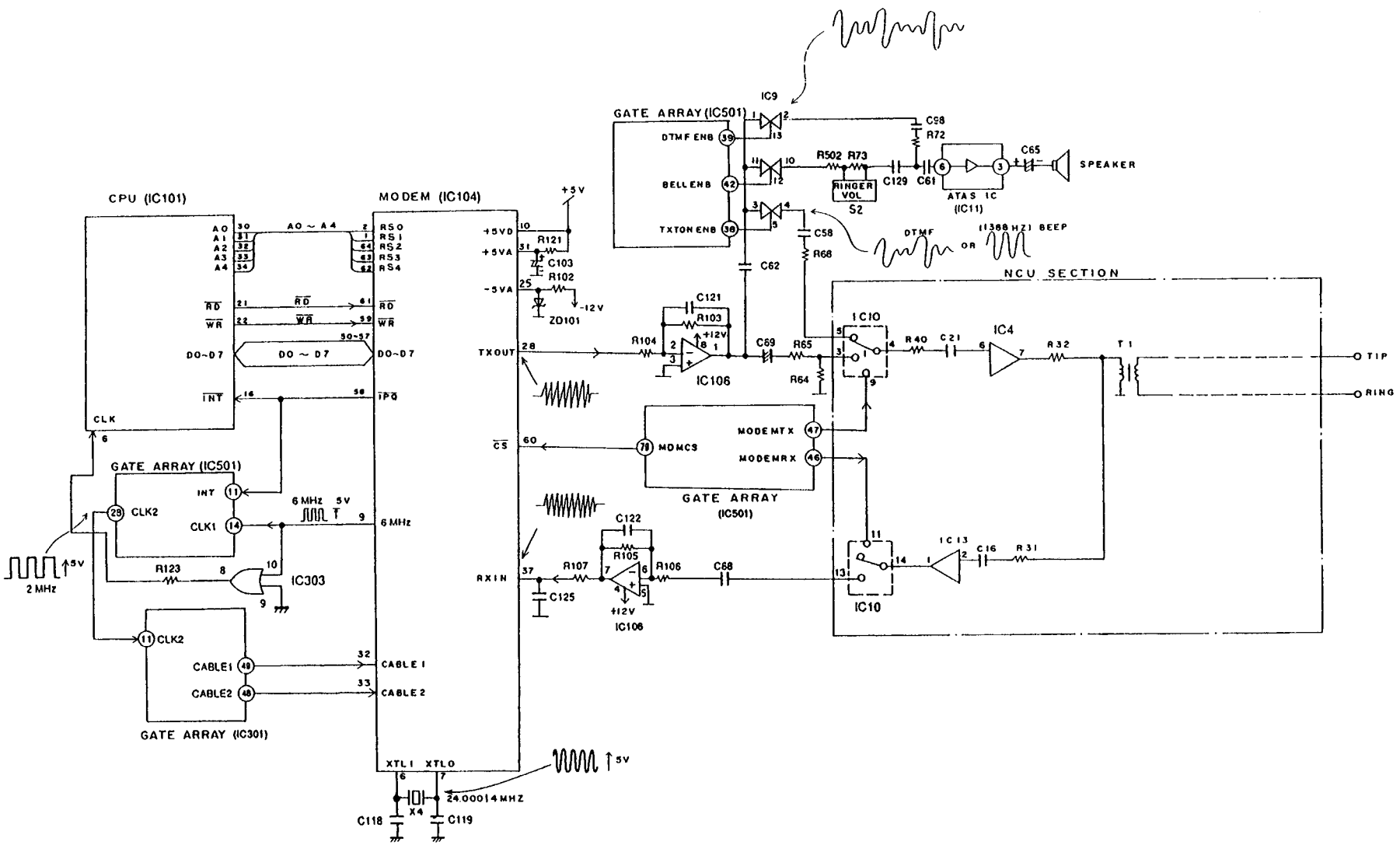
(DTMF Monitor Tone)
IC104(28)→R104→IC106(2)(1)→C62→IC9(1)(2)→C98→R72→IC11(6)(3)→C65→Speaker

4) Call Tone Transmission
The call signal which is generated in the modem (IC104) passes through analog switch IC9(11-10) and ATAS IC11(6-3) to the speaker.

IC104(28)→R104→IC106(2)(1)→C62→IC9(11)(10)→C129→IC4(6)(3)→C65→Speaker

5) Busy/Dial Tone Detection
The path is the same as for FAX receiving. When it is detected, the carrier detect bit of the register in the modem (IC104) becomes 1, and this status is monitored by the CPU (IC101).

Circuit Diagram



5. EXPLANATION OF ANALOG SECTION BLOCK DIAGRAM

1) Function

The analog section serves as interface with the telephone line. The digital board (IC104) for transmission and reception of FAX signals, the DTMF receiver (IC3) for remote signal detection, and the special ATAS IC (IC11) for general management of the ATAS operation are connected to the NCU section. Switching between the digital board (IC104) and the other sections and selection are executed by means of a multiplexer in the NCU section. The control signals to the individual analog sections are output mainly from the gate array IC15, and the status information for the various sections also is held in the gate array IC15. Simple explanations for the various sections are given below.

2) Circuit Operation

[NCU Section]

Interface with the telephone line. This is composed of bell detection circuit, CPC detection circuit, pulse dial generation circuit, amplifier circuit for line transmission and reception, sidetone circuit, multiplexer circuit, etc. See below for details.

[DTMF Receiver IC (IC3)]

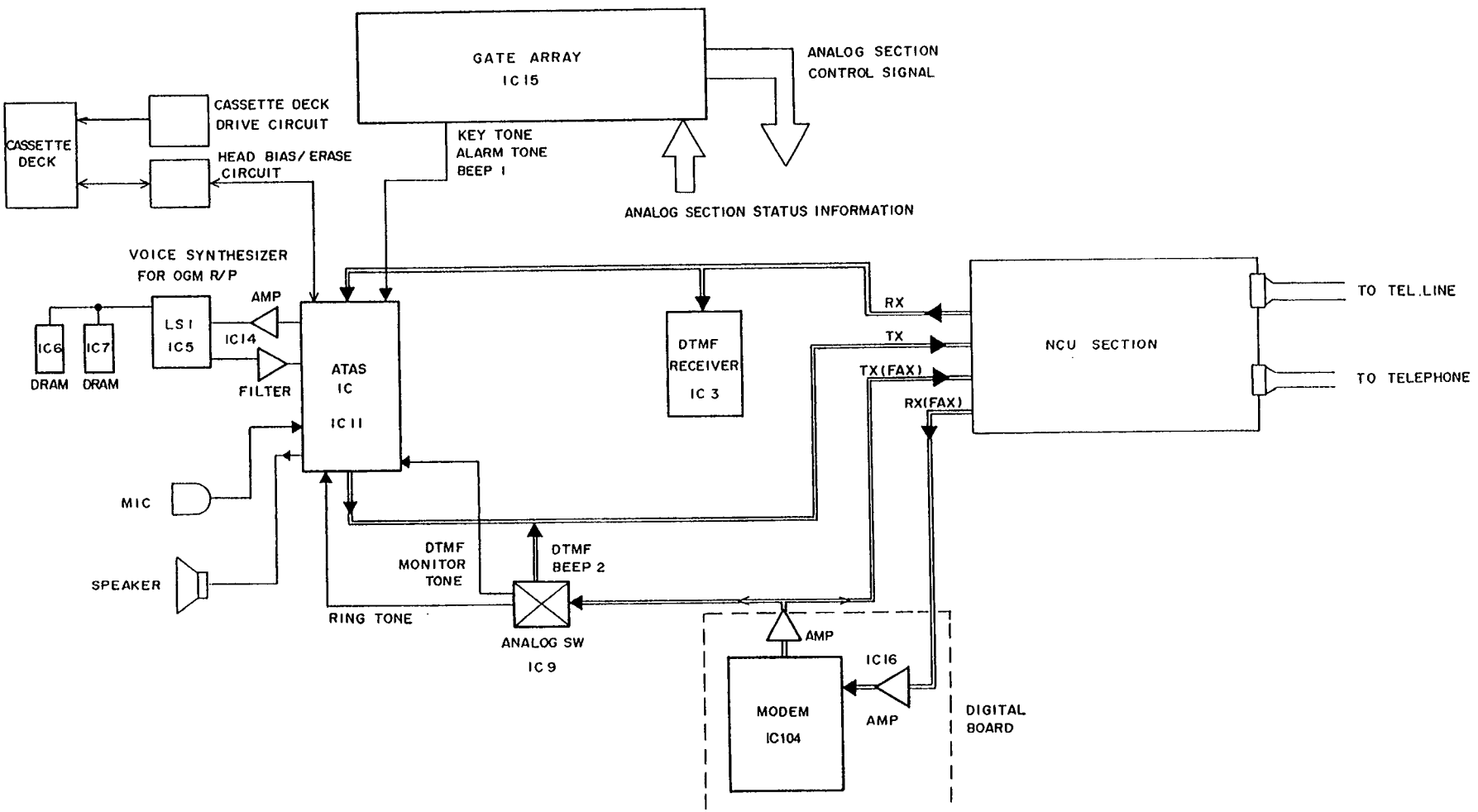
This permits remote operation from the line. See below for details.

[ATAS Special IC (IC11)]

This is a special IC for general management of the ATAS operation.
The voice synthesizer LSI (IC5) for OGM recording and playback, the DRAM (256kbit) x 2, the bias circuit for cassette deck recording and playback, the microphone, and the speaker are connected to this IC.
The key tone, the ATAS beep (Beep 1), and the alarm tone generated by digital board (CN4) are output to the speaker via the built-in power amplifier.

[Modem (IC104)]

This is used for FAX signal tone modulation, DTMF signal transmission, ring tone generation, and line transmission beep (Beep 2) generation. The DTMF signal and Beep 2 are placed onto the TX system via the analog switch IC9.
The ring tone also passes through the analog switch IC9.
It is given as input to the special ATAS IC (IC11), and it is output to the speaker via the built-in power amplifier.


GATE ARRAY
IC15
ANALOG SECTION
CONTROL SIGNAL
CASSETTE DECK
DRIVE CIRCUIT
CASSETTE
DECK
HEAD BIAS/ERASE
CIRCUIT
KEY TONE
ALARM TONE
BEEP 1
ANALOG SECTION STATUS INFORMATION
VOICE SYNTHESIZER
FOR OGM R/P
AMP
LSI
IC5
IC14
IC6
IC7
DRAM
DRAM
FILTER
ATAS
IC
IC11
DTMF
RECEIVER
IC 3
RX
TX
TX(FAX)
RX(FAX)
NCU SECTION
TO TEL.LINE
TO TELEPHONE
MIC
SPEAKER
DTMF
MONITOR
TONE
DTMF
BEEP 2
RING TONE
ANALOG SW
IC9
AMP
IC16
AMP
MODEM
IC104
DIGITAL
BOARD

6. NCU SECTION

6-1. GENERAL

This section is the interface with the telephone line, and it is composed of line relay (RLY1), bell detection circuit, pulse dial circuit, CPC detection circuit, line amplifier and sidetone circuits and multiplexer.

6-2. LINE RELAY (RLY1)

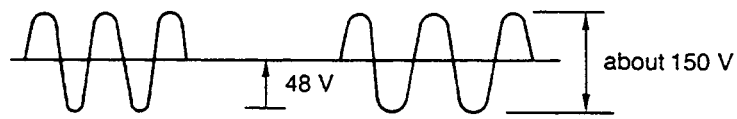
1) Circuit Operation
This relay switches to the set side (make) when the set uses the line and it switches to the external telephone side (break) when a call is made.

IC15(41) High Level→Q6 ON→RLY1 (make)

6-3. BELL DETECTION CIRCUIT

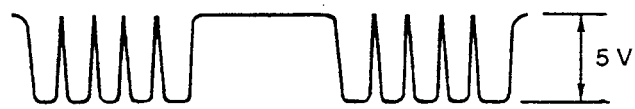
1) Circuit Operation
Signal waveform of each section are indicated below. Signal (low level section) input to pin 35 of gate array IC15 are read out at CPU and judged as bell.

Between Tip and Ring



Between PC1(1) and (2)

PC1(4)/Gate Array IC15(35)



T→L1→L5→RLY1→R1→PC1 (1→2)→C1→RLY1→L6→L2→R

6-4. PULSE DIAL CIRCUIT

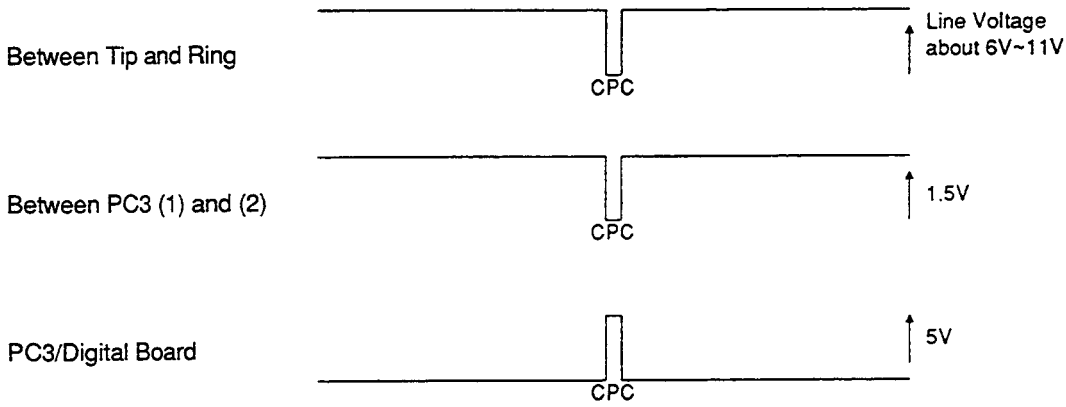
1) Circuit Operation
When RLY1 becomes ON, current flows via R11 to the base of Q2, Q2 becomes ON, and Q1 also becomes ON.
At the time of pulse dial operation, the photocoupler PC2 pin (2) becomes low level by IC15 pin (40), so that PC2 pin (4) becomes low level, Q2 becomes OFF, and Q1 also becomes OFF line ON/OFF by high/low control for IC15 pin (40) makes pulse dial operation possible.

IC15 (40) Low Level→PC2 (2) Low Level→Q2 OFF→Q1 OFF→Telephone Line

6-5. CPC DETECTION CIRCUIT

1) Circuit Operation

For detection of temporary line disconnection during on line condition, CPC detection is executed after dc loop formation as shown in the figure.
As the line voltage always is applied between (1) and (2) of photocoupler PC3 during DC loop formation, PC3 (4) always is low level. PC3 (4) momentarily becomes high level by line disconnection.
This read by digital board and CPC is detected.



As the CPC signal time differs according to the exchange, selection is possible by key input.

	A	B
OK	more than 8 msec	more than 600 msec
NG	less than 5 msec	less than 350 msec

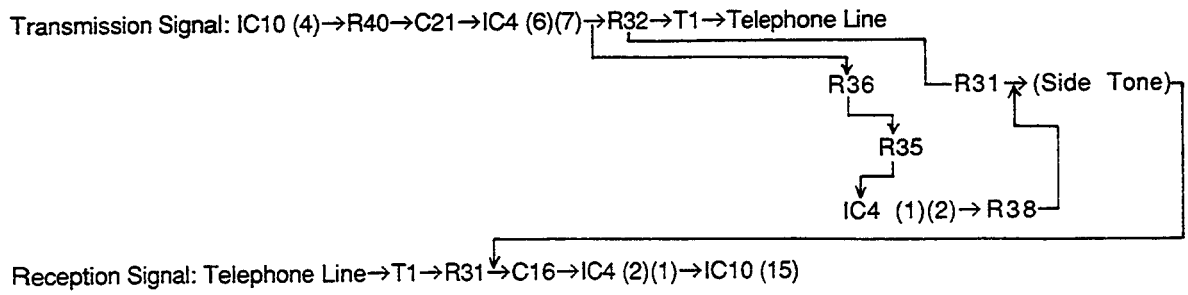
2) The Signal Path

T→L1→L5→RLY1→D30→Q1→R178→Q3→R145→PC3(1→2)→D30→RLY1→L6→L2→R

6-6. LINE AMPLIFIER AND SIDE TONE CIRCUITS

1) Circuit Operation

The reception signal received as input from the line transformer T1 is given as input from R31, C16 to IC13 pin (2), and it is output to the reception system at an amplifier gain of 3dB from pin 1.
The transmission signal given as input to IC4 pin (6) via R40, C21 is amplified to about 20dB, it is output from pin 7 of IC4, and it is transmitted to the via R32, T1. Without IC4 pins (1)(2), the transmission signal here would return completely to the reception amplifier via R31. Here, the signal output from IC4 pin (7) passes through R36, R35 and enters the reversion amplifier IC13 pin (2), a signal with the reverse phase of the transmission signal is formed at IC13 pin (1), and this is used to cancel the return part of the transmission signal. This is the sidetone circuit.



6-7. MULTIPLEXER (IC10)

This multiplexer is used for switching and selecting the transmission and reception system of the FAX circuit (modem) and the transmission and reception system of the ATAS/ITS circuit.

	Control	Switch Mode
ATAS/ITS Operation	TEL=High (pin 10) MODEMRX=Low (pin 11) MODEMTX=Low (pin 9)	Y-Y1 ON (pins15-1) X-X0 ON (pins 14-12) Z-Z0 ON (pins 4-5)
FAX Operation	TEL=Low (pin 10) MODEMRX=High (pin 11) MODEMTX=High (pin 9)	Y-Y0 ON (pins15-2) X-X1 ON (pins 14-13)
Dialing Operation	TEL=High (pin 10) MODEMRX=High (pin 11) MODEMTX=Low (pin 9)	Y-Y1 ON (pins15-1) X-X1 ON (pins 14-13)

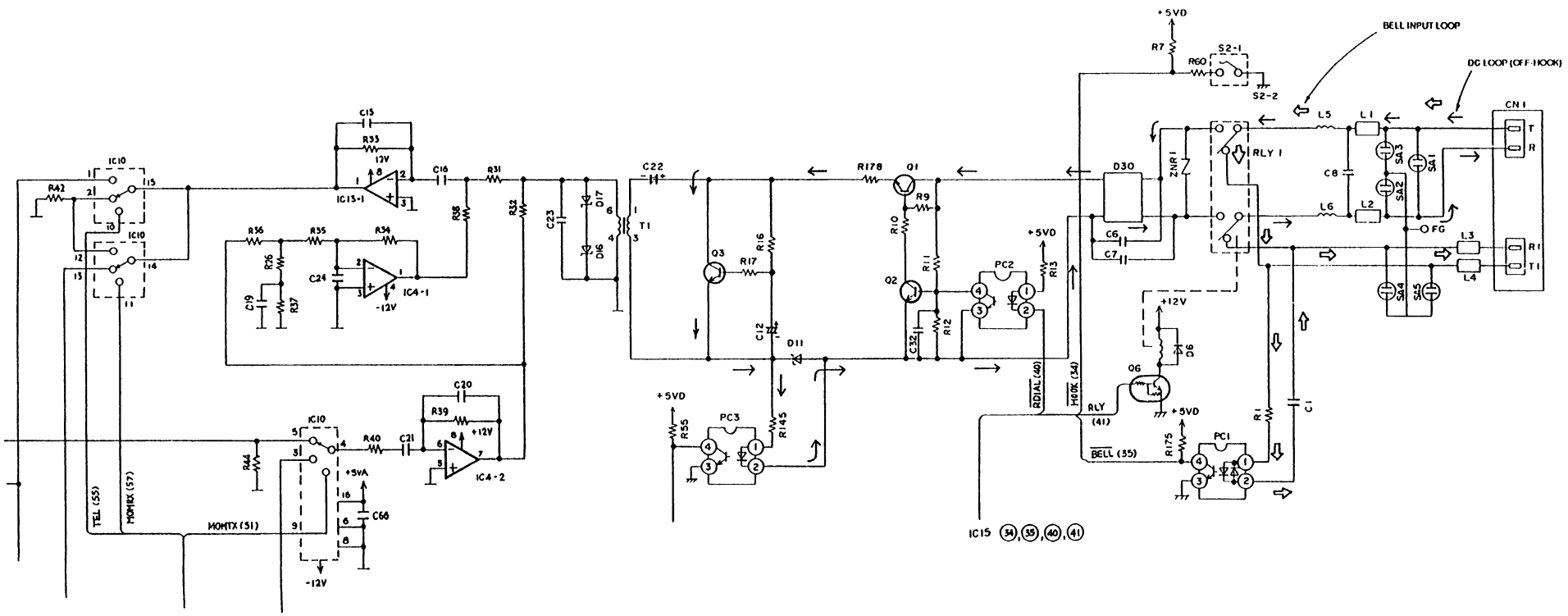
Note:
As the modem executes tone detection the time of dialing, the ATAS/ITS circuit and the modem are connected to the reception system, i.e. MODEMRX=high level because of TEL=high level.

Control Mode for NCU Section Table

	Control Input to NCU					Control Output from NCU	
	RLY1 (make) TRLY	Q1 (OFF) PDIAL	IC10 (15)-(1) ON TEL	IC10 (14)-(13) ON MODEMRX	IC10 (4)-(3) ON MODEMTX	BELL	CPC
Wait Condition	0	1	1	0	0	---	---
During the Bell Input	0	1	1	0	0	1/0	---
During the FAX Communication	1	1	1	0	1	1	----
During the ATAS/ITS Off-Hook	1	1	1	0	0	---	---
During the Pulse Dial	1	1/0	1	0	0	---	---
During the Tone Dial	1	1	1	0	0	---	---
CPC Input	1	1	1	0	0	---	0→1
External TEL Off-Hook of During the Off-Hook	---	---	---	---	---	---	---
External TEL On-Hook of During the On-Hook	---	---	---	---	---	---	---

1: High Level (5V) 0: Low Level

Circuit Diagram



7. ITS (INTEGRATED TELEPHONE SYSTEM) AND MONITOR SECTIONS

7-1. GENERAL

At the time of speakerphone operation, the speaker output passes through the power amplifier of the special ATAS IC (IC11). The DTMF signal, the line transmission beep (Beep 1), and the bell tone are output from the digital board (IC104) and distributed by the analog switch (IC9). The alarm tone, the key tone, and the ATAS beep (Beep 1) are output from the digital board. At the time of pulse dial operation, the monitor tone is output from the digital board.

7-2. MONITOR CIRCUIT

1) DTMF Monitor
CN4 (12)→C62→IC9(1)(2)→C98→R72→C61→IC11[(6)→POWER AMP→(3)]→C65→Speaker

2) DTMF Signal for Line Transmission
CN4 (12)→C69→R65→NCU[IC10(3)(4)]→TEL. Line

3) Beep Tone (1388Hz)
CN4 (12)→C62→IC9(3)(4)→C58→R68→NCU[IC10(5)(4)]→TEL. Line

4) Bell Signal
CN4 (12)→C62→IC9(11)(10)→R502 (Low) →R73→C129→C61→IC11[(6)→POWER AMP→C65→Speaker
R502 (High) →IC9(9)(8)→R73→C129→C61→IC11[(6)→POWER AMP→C65→Speaker

5) Key Tone(1388Hz)
CN4 (6)→R78→C306→C61→IC11[(6)→POWER AMP→(3)]→C65≠Speaker

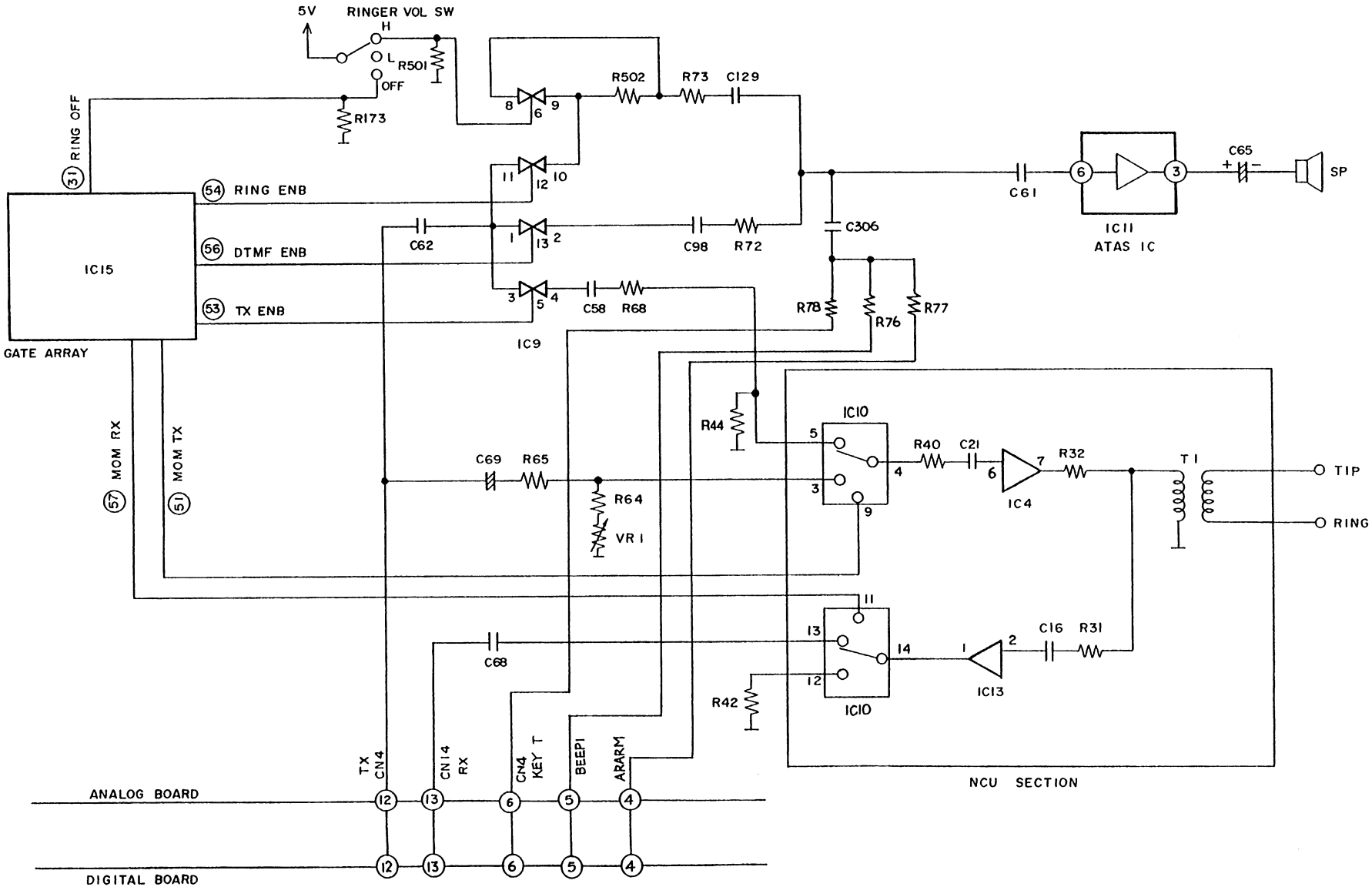
6) Alarm Tone(2780Hz) and ATAS Beep Tone(1388Hz)
Alarm: CN4(4)→R77→C306→C61→IC11[(6)→POWER AMP→(3)]→C65→Speaker
Beep 1: CN4(5)→R76→C306→C61→IC11[(6)→POWER AMP→(3)]→C65→Speaker

Monitor Tone Control Table

	S/H	RMUTE	TMUTE	SP MUTE	BELL ENB	DTMF ENB	TXTON ENB	PDIAL	ALARM	Beep1	KEYTON	MODEM TXOUT
Bell Ringing	0	1	---	0	1	0	0	1	0	0	0	Bell Out
Monitor Tone Dial	1	1	---	0	0	1	0	1	0	0	0	DTMF Out
Monitor Pulse Dial	1	1	---	0	0	0	0	1/0	0	0	1/0	X
Beep 2 Line transmission	0	1	---	1	0	0	1	1	0	0	0	Beep2 Out
Alarm Ringing	0	1	---	0	0	0	0	1	1/0	0	0	X
Beep 1 Ringing for ATAS	0	1	---	0	0	0	0	1	0	1/0	0	X
Key Tone Ringing	0	1	---	0	0	0	0	1	0	0	1/0	X

1: High Level(5V) 0: Low Level(0V) Beep 1/Beep2/KEYTON: 1388Hz ALARM: 2780Hz

Circuit Diagram



8. ATAS SECTION

8-1. MAIN SECTION

1) Function

The ATAS main operation is executed by the special IC11. Control signal for changing internal IC route are input gate array IC15.

2) Signal Path and Circuit Operation

(Record)

(1) OGM Record (from microphone)

MIC→R134→C96→IC11[(10)→ATT→MIC AMP→SW4→(21)]→Q14→C119→R150→IC14(2)(1)→C123→IC5(2)(16) →IC6(2)/IC7(2)

(2) OGM Record (from line)

TEL. Line→NCU Section[IC10(15)(1)]→R85→C53→C54→IC30(6)(7)→C97→R135→IC11[(11)→ATT→SW5→(21)] →Q14→C119→R150→IC14(2)(1)→C123→IC5(2)(16) →IC6(2)/IC7(2)

(3) ICM Record (from line)

TEL. Line→NCU Section[IC10(15)(11)]→R85→C53→C54→IC8(6)(7)→C97→R135→IC11[(11)→ATT→SW5→(21)] →Q14→C112→R101→C109→IC4[(19)→REC AMP→SW6-B→SW7→(18)]→C110→CN9(1)→R/P Head

(4) Memo Record

MIC→R134→C96→IC11[(10)→ATT→MIC AMP→SW4→(21)]→Q14→C112→R101→C109→IC11[(19)→REC AMP→ SW6-B→SW7→(18)]→C110→CN9(1)→R/P Head

(5) OGM Tape Backup Record

IC6(2)→IC5(16)(3)→C124→R104→R148→R147→IC14(6)(7)→R151→C43→C112→R101→C109→IC11 [(19)→REC AMP→SW6-B→SW7→(18)]→C110→CN9(1)→R/P Head

(6) Tape Backup OGM→DRAM

R/P Head→C110→IC11[(18)→OGM AMP→PLAY AMP→SW6-A→(21)]→Q14→C119→R150→IC14(2)(1)→C123→ IC5(2)(16)→IC6(2)/IC7(2)

(7) Write the Beep1 to ICM Tape

CN4(5)→C43→R159→C109→IC11[(19)→REC AMP→SW6-B→SW7→(18)]→C110→CN9(1)→R/P Head

(Playback)

(1) ICM PLay (to speaker)

R/P head→C110→IC11[(18)→OGM AMP→PLAY AMP→SW6-A→(21)]→Q14→C112→IC11[(22)→SP AMP→SW2→ (7)]→C82→VR5→R203→R136→C94→IC8(2)(1)→C63→R92→IC11[(6)→POWER AMP→SW1→(3)]→C65→Speaker

(2) ICM Play (to line)

R/P head→C110→IC11[(18)→OGM AMP→PLAY AMP→SW6-A→(21)]→Q14→C112→IC11[(22)→L-OUT AMP→SW3 →(24)]→C87→R164→R165→IC16(3)(1)→C67→R119→NCU Section[IC10(5)(4)]→TEL. Line

(3) OGM Play (to speaker)

IC6(2)/IC7(2)→IC5(16)(3)→C124→R104→R148→R147→IC14(6)(7)→R151→C43→C112→IC11[(22)→SP AMP→ SW2→(7)]→C82→VR5→R203→R136→C94→IC8(2)(1)→C63→R92→IC11[(6)→POWER AMP→SW1→(3)]→ C65→Speaker

(4) OGM Play (to line)

IC6(2)/IC7(2)→IC5(16)(3)→C124→R104→R148→R147→IC14(6)(7)→R151→C43→C112→IC11[(22)→L-OUT AMP→ SW3→(24)]→C87→R164→R165→IC16(3)(1)→C67→R119→NCU Section[IC10(5)(4)→TEL. Line

(VOX)
The VOX circuit is the circuit for discrimination of tone or no tone. [IC11 pin (25) is low level with tone and high level with no tone.] The role of this circuit is explained in the following.

(1) When no tone is recognized at the time of ICM recording from the line, the recording is ended.

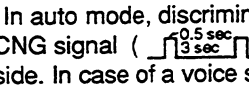
TEL. Line→NCU Section[IC10(15)(1)→R85→C53→C54→IC8(6)(7)→C97→R135→IC11[(11)→ATT→LINE AMP→ SW5→(21)]→Q14→C112→C152→R86→R122→IC11[(27)→VOX DETECTION CIRCUIT→(25)]→IC15(19)

(2) When no tone is recognized at the time of OGM recording from the microphone, the recording is ended.
This is done because suitable tape backup at the time of OGM tape backup is not possible when recording is not done at or above a certain level.

MIC→R134→C96→IC11[(10)→ATT→MIC AMP→SW4→(21)]→Q14→C112→IC11[(22)→VOX DETECTION CIRCUIT →(25)]→IC15(19)

(3) No tone discrimination is executed to detected the OGM end at the time of copying the tape backup OGM to the D-RAM.

R/PHead→CN9(1)→C110→IC11[(18)→OGM AMP→PLAY AMP→SW6A→(21)]→Q14→C112→C152→R86→R122→ IC11[(27)→VOX DETECTION CIRCUIT→(25)]→IC15(19)

(4) In auto mode, discrimination of FAX or human is made for 5sec after OGM transmission, and in case of no tone or CNG signal (

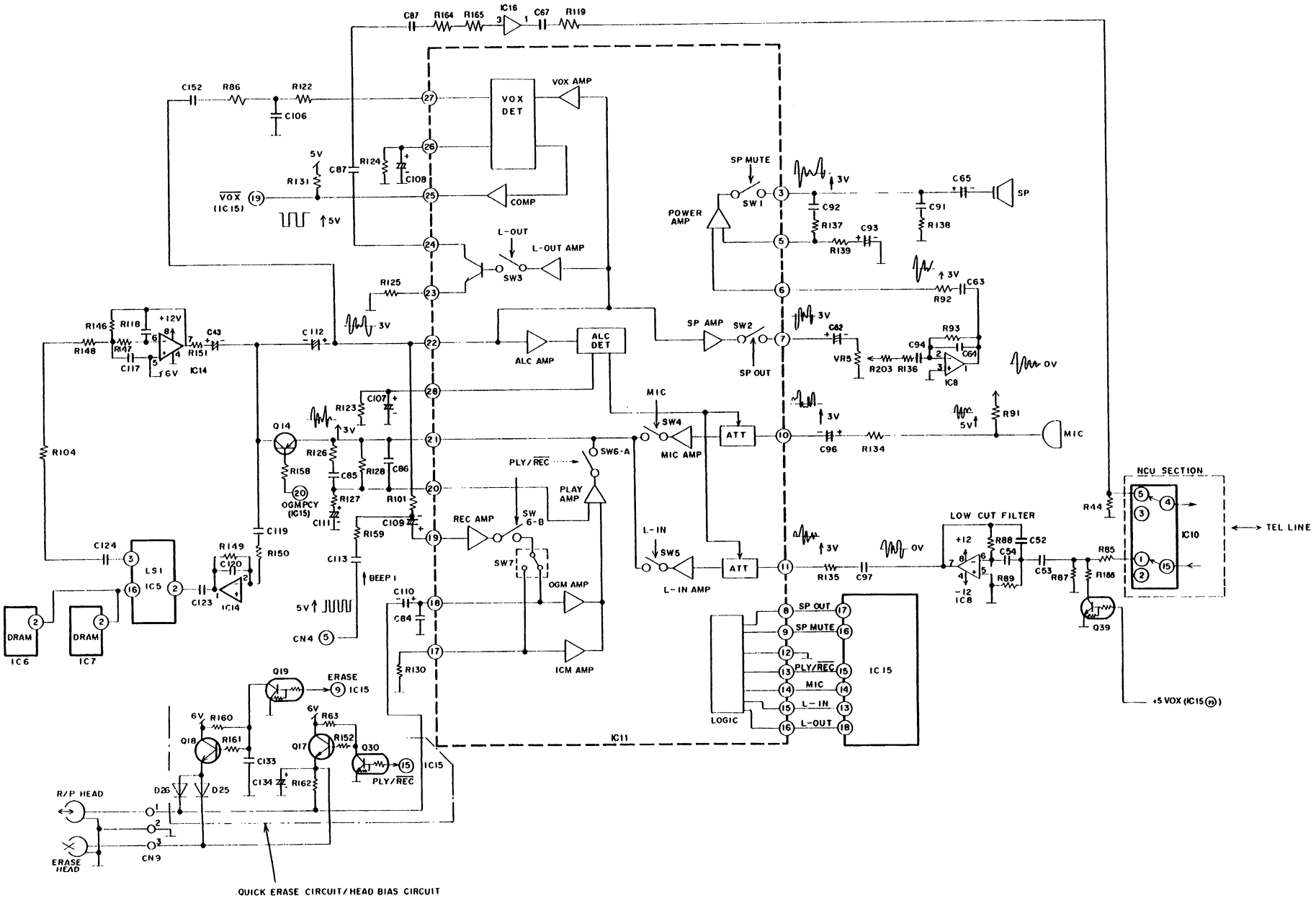
): Identification signal that a FAX is on the transmission side), shifting is made to the FAX side. In case of a voice signal, shifting is made to ICM recording.
The path is the same as for 1). Discrimination between CNG signal and voice signal is executed by the CPU monitoring the input to IC15 pin (19) and using a certain algorithm. Q39 is switched OFF only for 5sec after OGM transmission in auto mode. This is done because CNG signal discrimination also must be executed during this time, and it is done for adjustment of the VOX sensitivity. Control is executed from IC15 pin (19).

Control Table for ATAS Main Section

	SW2 ON by High SPOUT	SW1 OFF by High SPMUTE	SW6-A ON, SW6-B OFF, Q17 OFF by High PLY/REC	SW4 ON by High MIC	SW5 ON by High L-IN	SW3 ON by High I-OUT	Q14 OFF by High OGMPLY	Q19 OFF by High ERASE	Q39 ON by High +5VOX
Wait Condition	0	1	1	0	0	0	1	1	1
During the Speaker-phone Communication	0	0	1	0	0	0	1	1	1
During the Dial	0	0	1	0	0	0	1	1	1
Aoto Mode (after OGM send, 5sec)	1	1	0	0	1	0	0	1	0
During the Quick Erase	0	1	0	0	1	0	1	0	1
Beep Record (to Tape)	0	1	0	0	0	0	1	1	1
OGM Record (from Microphone)	0	1	0	1	0	0	0	1	1
OGM Record (from Line)	1	0	0	0	1	0	0	1	1
ICM Record (from Line)	1	0	0	0	1	0	0	1	1
Memo Record	0	1	0	1	0	0	0	1	1
OGM Tape Backup	1	0	0	0	0	0	1	1	1
Tape Backup OGM DRAM	1	0	1	0	0	0	0	1	1
ICM PLAY (to Speaker)	1	0	1	0	0	0	0	1	1
ICM Play (to Line)	1	0	1	0	0	1	0	1	1
OGM Play (to Speaker)	1 0	0 1	1 1	0 0	0 0	0 1	1 1	1 1	1 1
OGM Play (to Line)	0	1	1	0	0	1	1	1	1

1: High Level (5V) 0: Low Level (0V)

Circuit Diagram



8-2. OGM RECORD/PLAYBACK CIRCUIT

1) OGM Recording

The voice signal input from microphone or line is output from the special ATAS IC11 pin (21), passes through Q14, is amplified by the amplifier IC14 pins (2)(1), and enters the voice synthesizer LSI IC5 pin (2). In the IC, the signal is converted to a digital signal, which is output from pin 16 to the 256KB D-RAM for storage.
One DRAM can store 8sec of voice data. The control timing chart is shown in Fig. 1.

IC4(21)→Q14→C119→R150→IC14 (2)(1)→C123→IC5 (2)→IC5(16)→IC6(2)/IC7(2)

2) OGM Playback

The digital voice signal data stored in D-RAM IC6, IC7 are output from pin 2, enter IC5 pin (16), an analog signal is synthesized on the inside, and this is output from pin 3. As the output signal is a stepped synthesized wave, smoothing is executed by the high-cut filter IC14, the signal enters the special ATAS IC11 pin (22) via C112, and it is output to the speaker or to the line. At the time of tape backup, the signal enters IC11 pin (19) via R101, C109, and tape backup is executed via the tape route. The control timing is shown in Fig. 1.

(Line Send Operation)

IC6(2)→IC5(16)→IC5(3)→C124→R104→R148→R147→IC14(6)(7)→R151→C43→C112→IC11(22)(24)→C87→R164→
→R165→IC16(3)(1)→C67→R119→NCU Section [IC10(5)(4)]→TEL. Line

(Speaker Output Operation)

IC6(2)→IC5(16)→IC5(3)→C124→R104→R148→R147→IC14(6)(7)→R151→C43→C112→IC11(22)(7)→C82→VR5→
R203→R136→C94→IC8(2)(1)→C63→R92→IC11(6)(3)→C65→Speaker

(Tape Backup Operation)

IC6(2)→IC5(16)→IC5(3)→C124→R104→R148→R147→IC14(6)(7)→R151→C43→C112→IC11(19)(18)→C110→
CN9(1)→R/P Head

Timing Chart

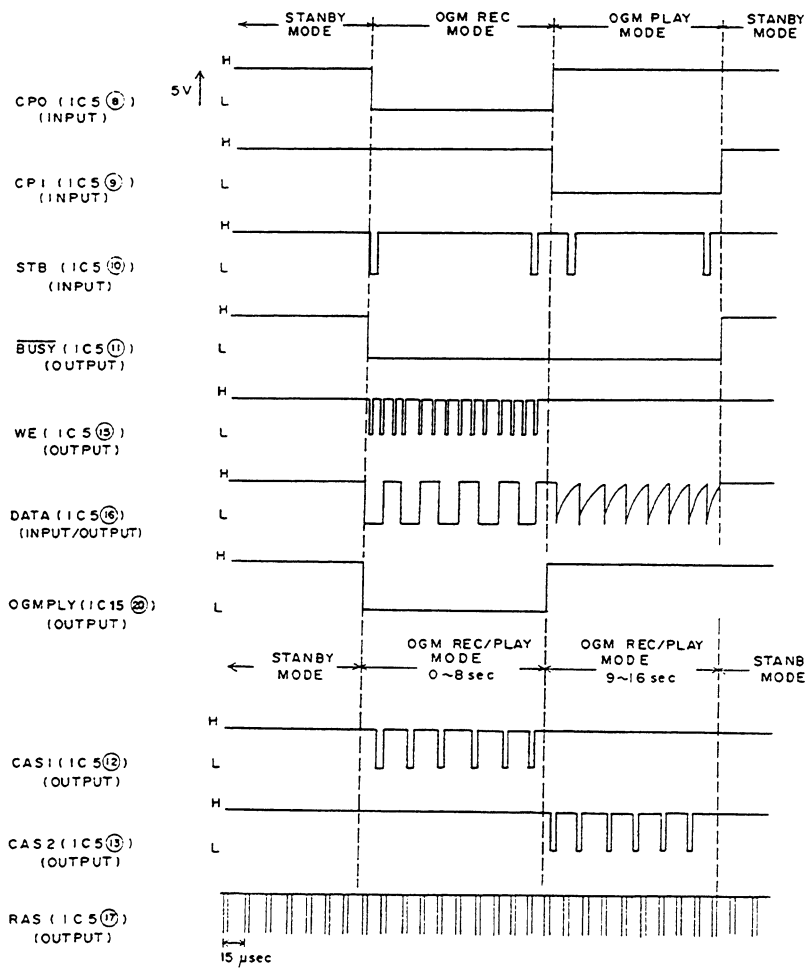
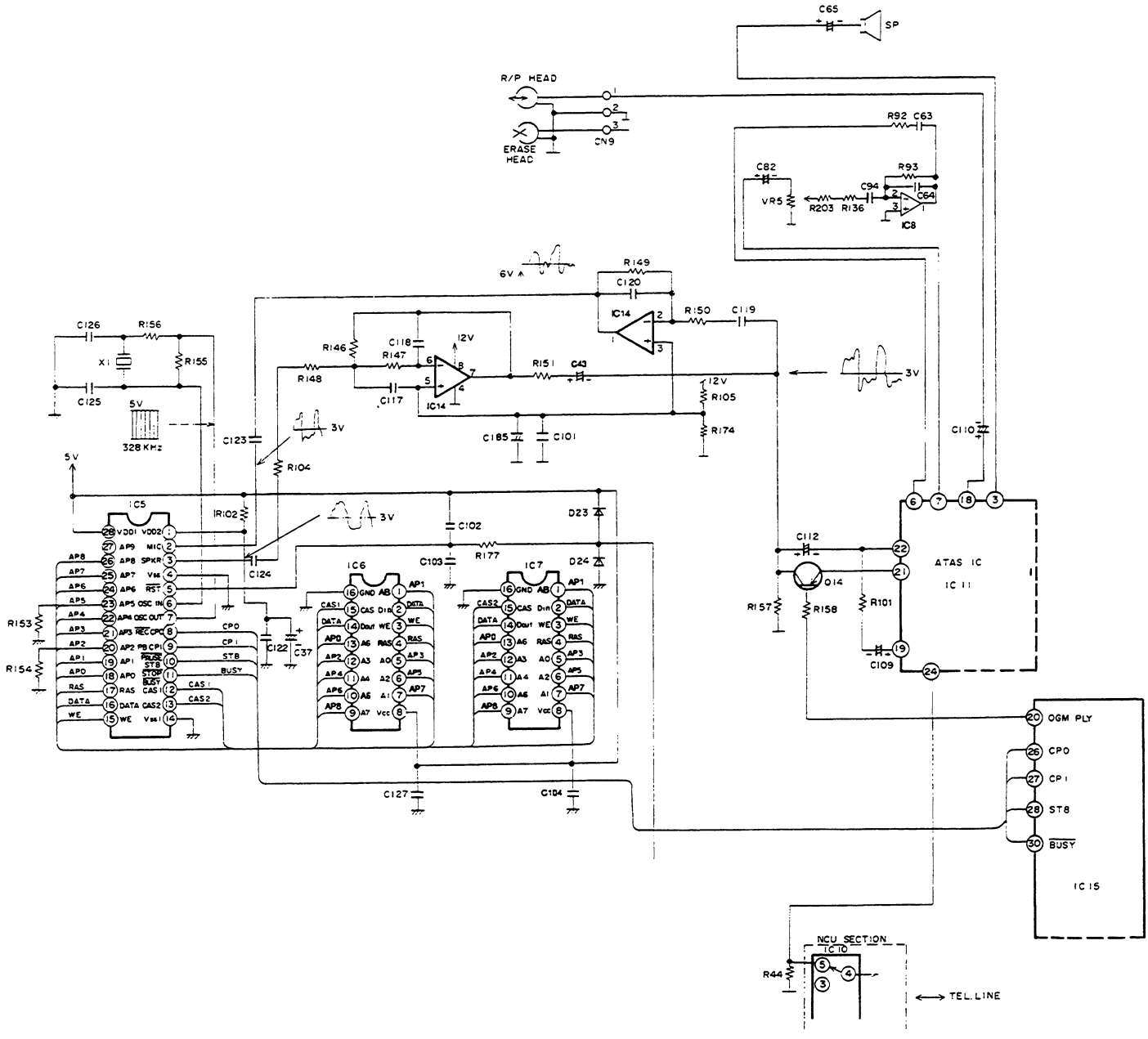


Fig. 1

Circuit Diagram



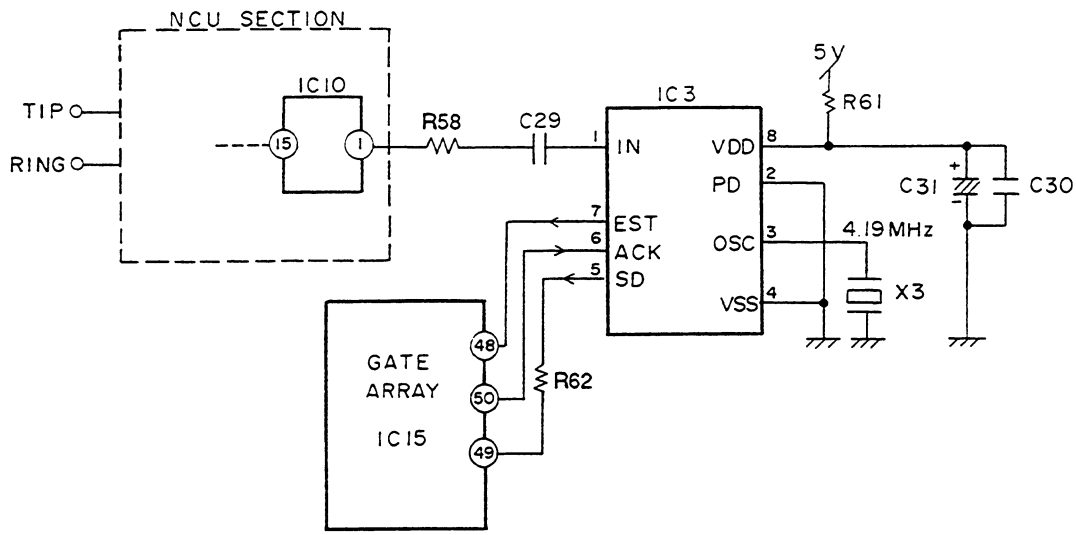
8-3. REMOTE SIGNAL DETECTION CIRCUIT

1) Circuit Operation

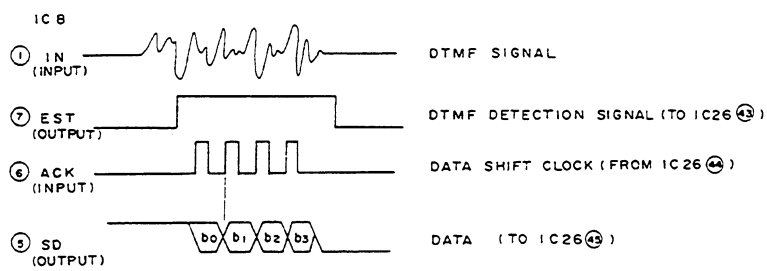
The DTMF signal is used as control signal. The remote signal enters from the telephone line, passes through the NCU section, and enters at pin 1 of IC3. IC3 converts this signal to 4bit serial data which enter the gate array IC15.
The timing chart for the signals is shown below.

Telephone Line→NCU Section [IC10(15)(1)]→R58→C29→IC3 (1)

Circuit Diagram



Timing Chart



8-4. QUICK ERASE AND HEAD BIAS CIRCUITS

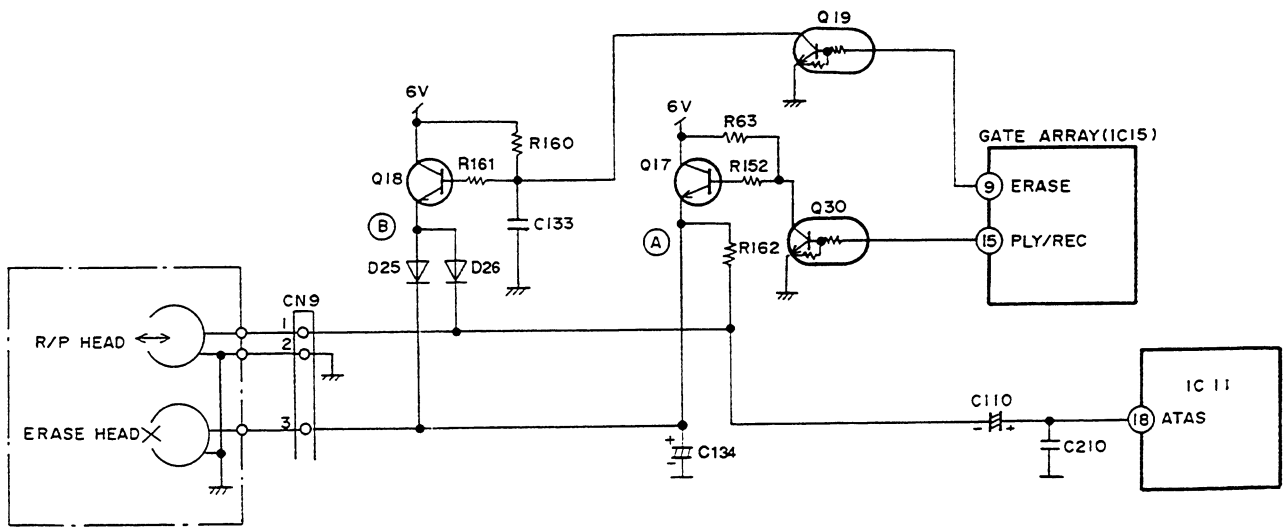
1) Circuit Operation

(Tape Record Operation)
The gate array IC15 pin (15) becomes low level, Q30 becomes OFF, Q17 becomes ON, the voltage at point (A) becomes about 5V, and the DC bias current (about 130μA) flows via R162 to the record/playback head.
The recording current from IC11 pin (18) is superimposed onto this bias current, and the result is recorded.
At the time of recording, the erasing current (about 25mA) first flows through the erase head to erase previous recording contents.

(Tape Playback Operation)
The gate array IC15 pin (15) becomes high level, Q30 becomes ON, Q17 becomes OFF, the DC bias current does not flow to the record/playback head, and the playback signal (about -60dB) from the record/playback head passes through C110 and enters IC11 pin (18).

(Quick Erase Operation)
The gate array IC15 pin (9) becomes high level, Q18 becomes ON, the voltage at point (B) becomes about 5V, and AC current (about 20mA) flows via D25, D26 to the record/playback head and to the erase head. In other words, after erasing by the erase head, a no-tone recording is made by record/playback head for perfect erasing.

Circuit Diagram



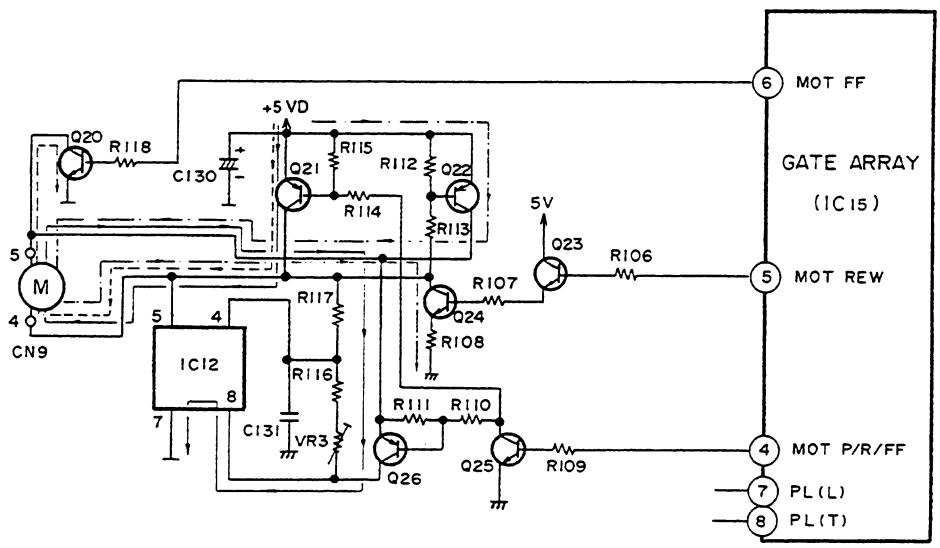
8-5. MOTOR (FOR CASSETTE DECK) DRIVE CIRCUIT

1)Playback (or Recording) (——→)
IC15 pin 4 becomes high level, and Q25 goes ON, hence Q26 and Q21 go ON, the governor IC12 operates, the motor current is controlled by IC12, hence the motor rotates at a constant speed.

2) Fast Forward (- - - →)
IC15 pins 4 and 6 becomes high level and Q25 and Q20 go ON, hence Q21 goes ON, and as the current does not pass through the governor IC12 and the plunger also is not pulled, the motor rotates at high speed.

3) Rewind (— - →)
IC15 pin 5 becomes high level and Q23 and Q24 go ON Consequently, Q22 also goes ON, and the motor current flows through Q22→Motor→Q24. Because this is the reverse direction to the current which flows in the above fast forward mode, the motor rotates at high speed in the reverse direction.

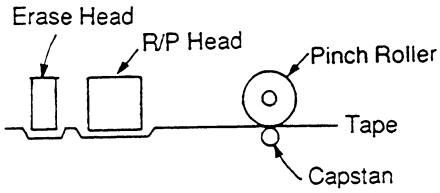
Circuit Diagram



8-6. TAPE TRANSPORT CONTROL CIRCUIT

1) Circuit Operation
The position relation between tape and erase head and record/playback head is decided by plunger control PL(L), P(T). When PL (L) and PL (T) both are high level, Q28, Q27 and Q29 become ON, current flows from +12V (——→) to the plunger, the plunger is started, and the head is shifted to the position where it comes into contact with the tape.
Afterwards, a holding current (- - - →) flows from +5V to hold this position. At this time, PL (L) is low level and Q28 and Q27 are OFF. At the time of (3) fast forward, Rewind in Fig. 1, PL (T) and PL (L) are low level, and the tape is not in contact with the heads. At the time of (1) Playback/Record and at the time of (2) Quick Erase, PL (L) is held at high level, and the tape is in contact with the heads. At the time of playback/record, the pinch roller is slightly further on the capstan side that at the time of quick erase, and the tape is caught between capstan and pinch roller for suitable loading, so that constant speed becomes possible.
The timing chart for motor and plunger control is shown in Fig. 2.

(1) Playback/Record



(2) Quick Erase

(3) Fast Forward, Rewind

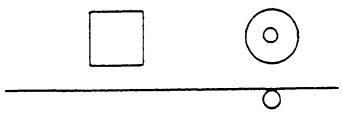
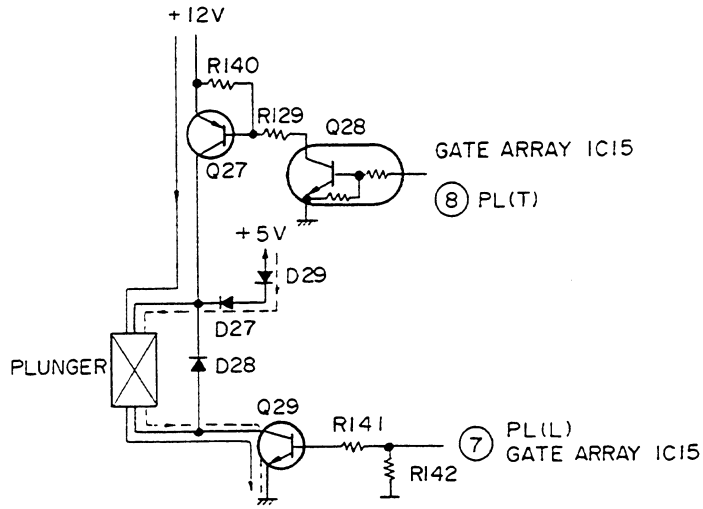


Fig. 1

Circuit Diagram



← Path of the current flowing to the plunger when PL(T) and PL(L) both are high level.

←- - - - Path of the current flowing to the plunger when only PL(L) is high level.

Timing Chart

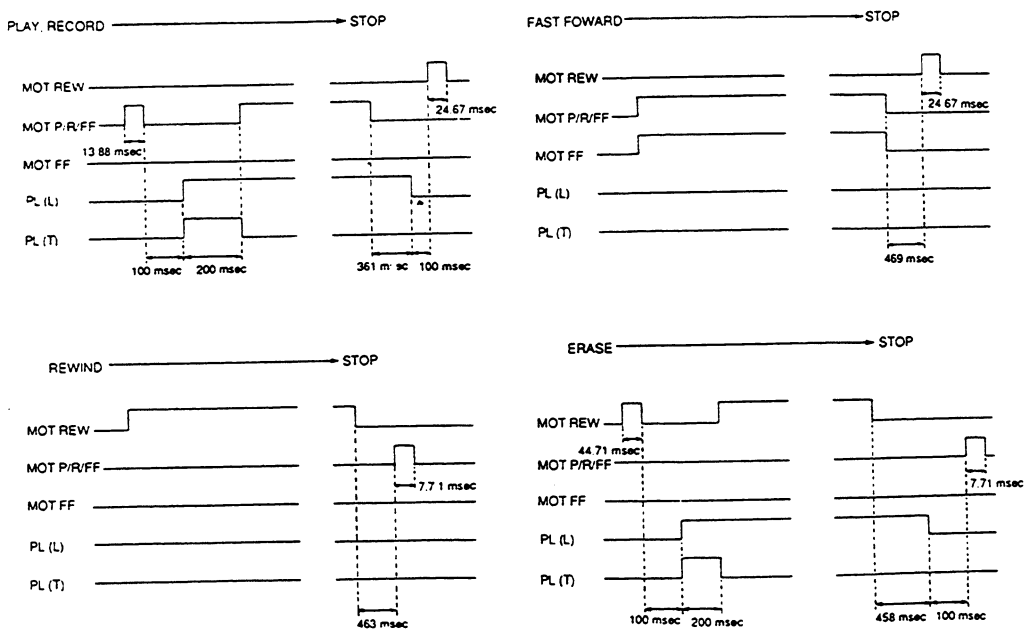


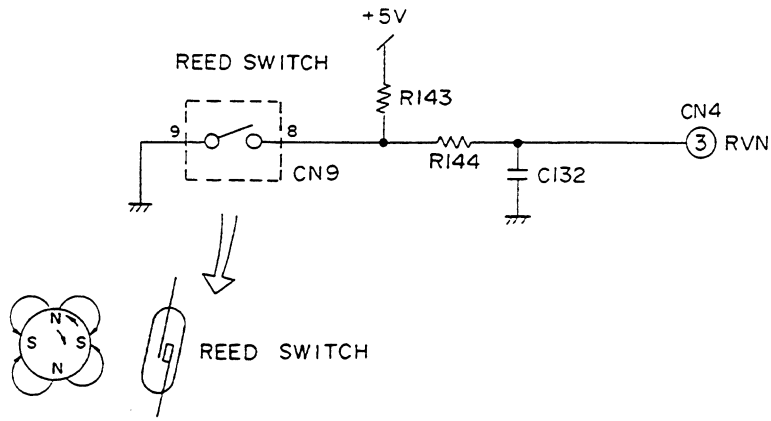
Fig. 2

8-7. ICM TAPE ROTATION DETECTOR CIRCUIT

1) Circuit Operation

The changes in the direction of the magnetic field caused by the rotation of the four-pole ferrite magnet are detected by the reed switch; this output is added to the pin 3 of CN4.

Circuit Diagram



9. SWITCHING POWER SUPPLY CIRCUIT

1) Circuit Operation

The 120 V AC power input from the AC cable passes through AC INLET and SW401 and is supplied to the power supply unit.

The AC power passes through the noise filter (consisting of C401, L401, L402, C402 and C403) to be smoothed by D401 and C451. C405 and C406 work as a surge absorber to protect the power supply from surge, while TH401 works as a power thermistor to prevent rush current.

The DC power smoothed is supplied through the resistor R454 to IC451, which outputs the frequency of about 120 kHz and switches on and off the Power MOS FET (Q405). This switching causes the DC power to be transmitted through T401 to the secondary circuit, where it is smoothed by D407 and C416 (DC 24 V output).

IC451 also performs the PWM control when the signals from the voltage detection section in the secondary circuit (consisting of the detection resistors R412 and R413 and the shunt regulator IC401) are transmitted to the primary circuit through PC401, which enables the constant output of 24 V.

Should the 24 V raise for some reason or other, this will be informed by signals from D402 and PC402 to IC451, which keeps down the power output to protect the secondary circuit.

The smoothed 24 V is chopped by Q403 and smoothed by L403 and C434 to output +5 V.

The voltage transmitted from T401 is smoothed by D406 and C420 and stabilized by IC403 to output +12 V.

In the same way, the voltage transmitted from T401 is smoothed by D409 and C423 and stabilized by IC404 to output −12 V.

When the Q403 breaks down, short mode is reached, +24V is supplied to the +5V system, and the set is destroyed. For this reason, abnormalities are detected by D415, the D415 is switched ON, the abnormal output is short-circuited, and the fuse (F403) blows to protect the set.

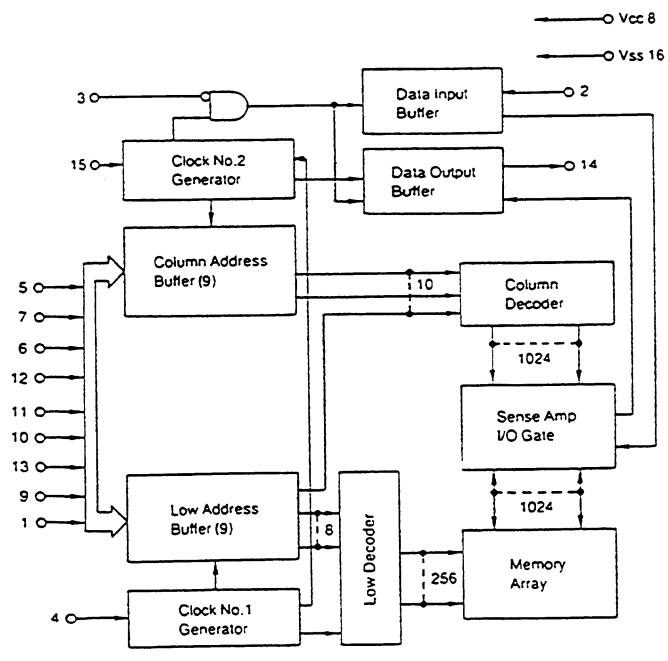
The applications of the various power supplies are shown below.
+24V...Thermal Head Power, Transmission Motor Power, Reception Motor Power, Relay Power of NCU Section
+12V...ATAS/ITS Telephone Line Interface Power
-12V....Modem Power, NCU Section Power
+5V.....Control Section Power, ATAS Plunger, Operation Board

When a completely black document etc. is copied for a long time (abnormal use), the power supply is highest and abnormal heating is caused. In this case, the condition is detected by thermistor (TH402) in close contact with the regulating diode of the 24V system (the resistance value decrease), and output (HEADON) of pin 11 of CN402 is input to A/D converter (IC201) inside the main board the operation is stopped to protect the set.
When the thermal head is not used, the +24V power supply for the thermal head is cut off by RLY401 to protect the thermal head. When the gate array IC301 pin 53 on the main circuit board (circuit) is made low level, Q404 becomes OFF, RLY401 becomes OFF, and no power is supplied.

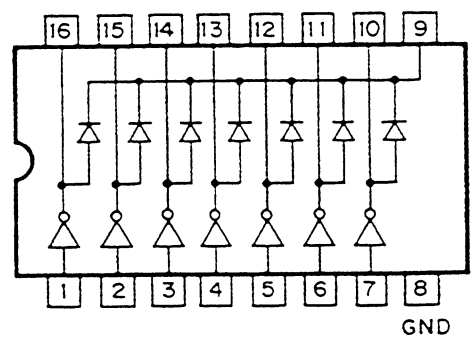
Circuit Diagram...Refer to pages 131 and 132.

IC BLOCK DIAGRAM

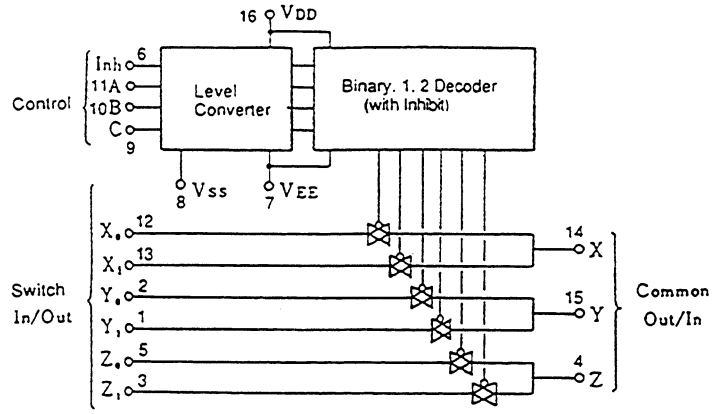
PQVITM41256A



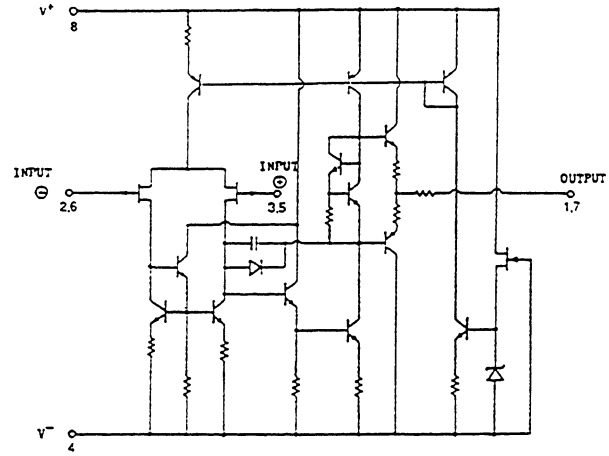
PQVIBA12003



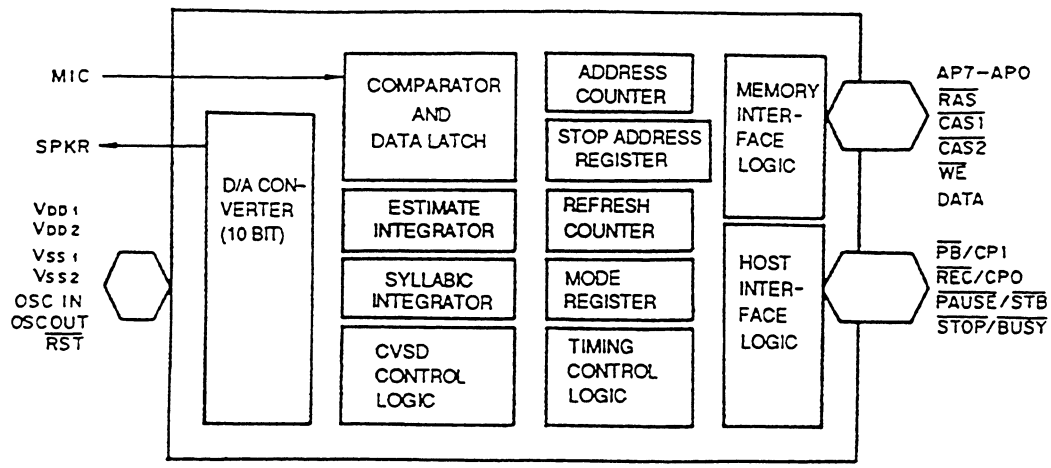
PQVINJ4053BM



PQVINJM082BM

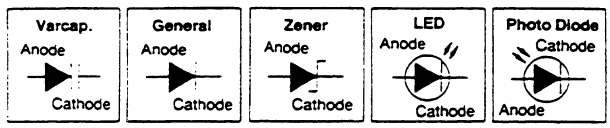


PQVITMS3477



SCHEMATIC DIAGRAM

Notes:

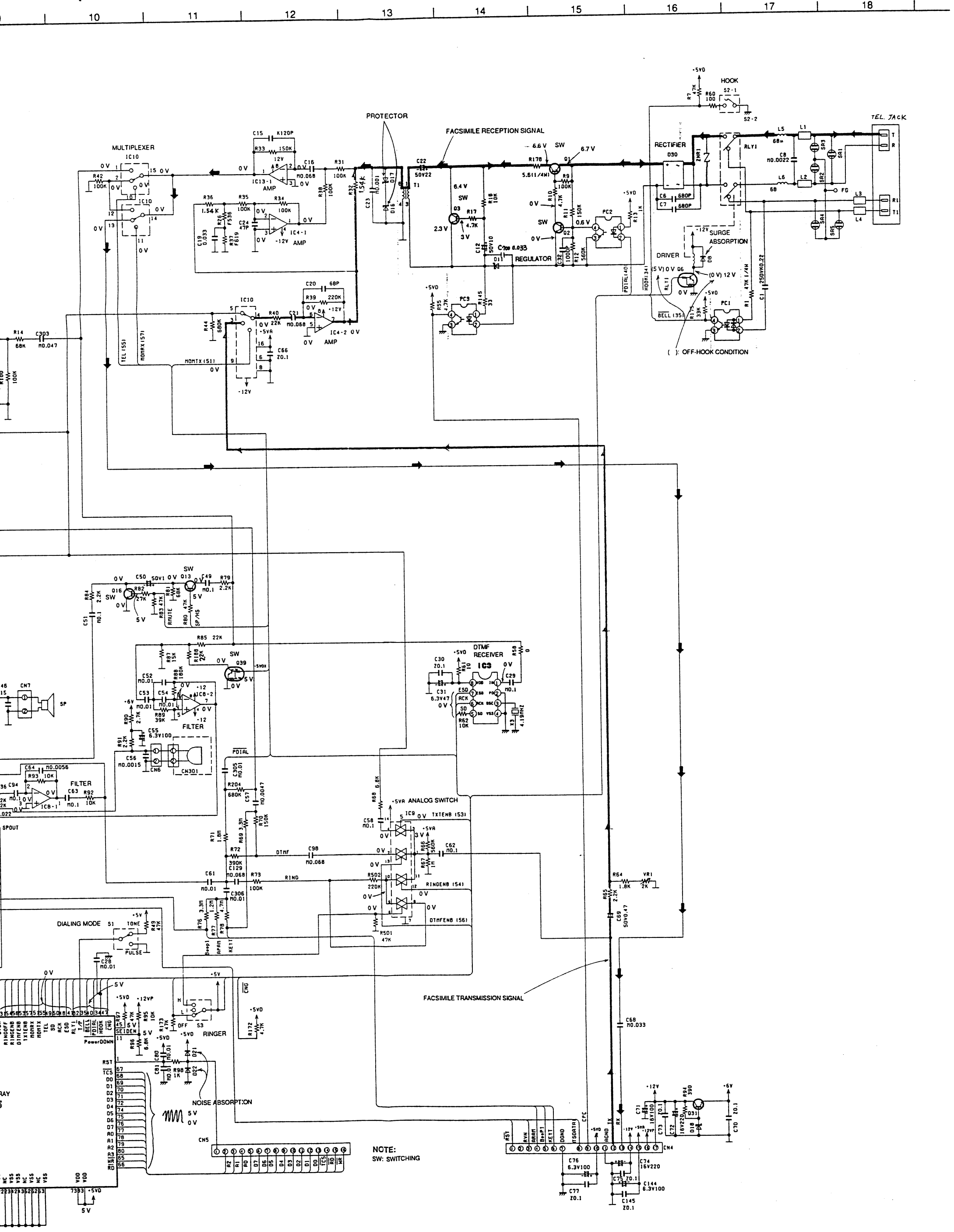
1. S1: Dialing mode selector switch in "TONE" position.
2. S2: Hook switch in "ON-HOOK" position.
3. S3: Ringer volume selector switch in "LOW" position.
4. SW901: Cover open switch.
5. DC voltage measurements are taken with oscilloscope from ground.
6. The schematic diagram and circuit board may be modified at any time with the development of new technology.
7. 

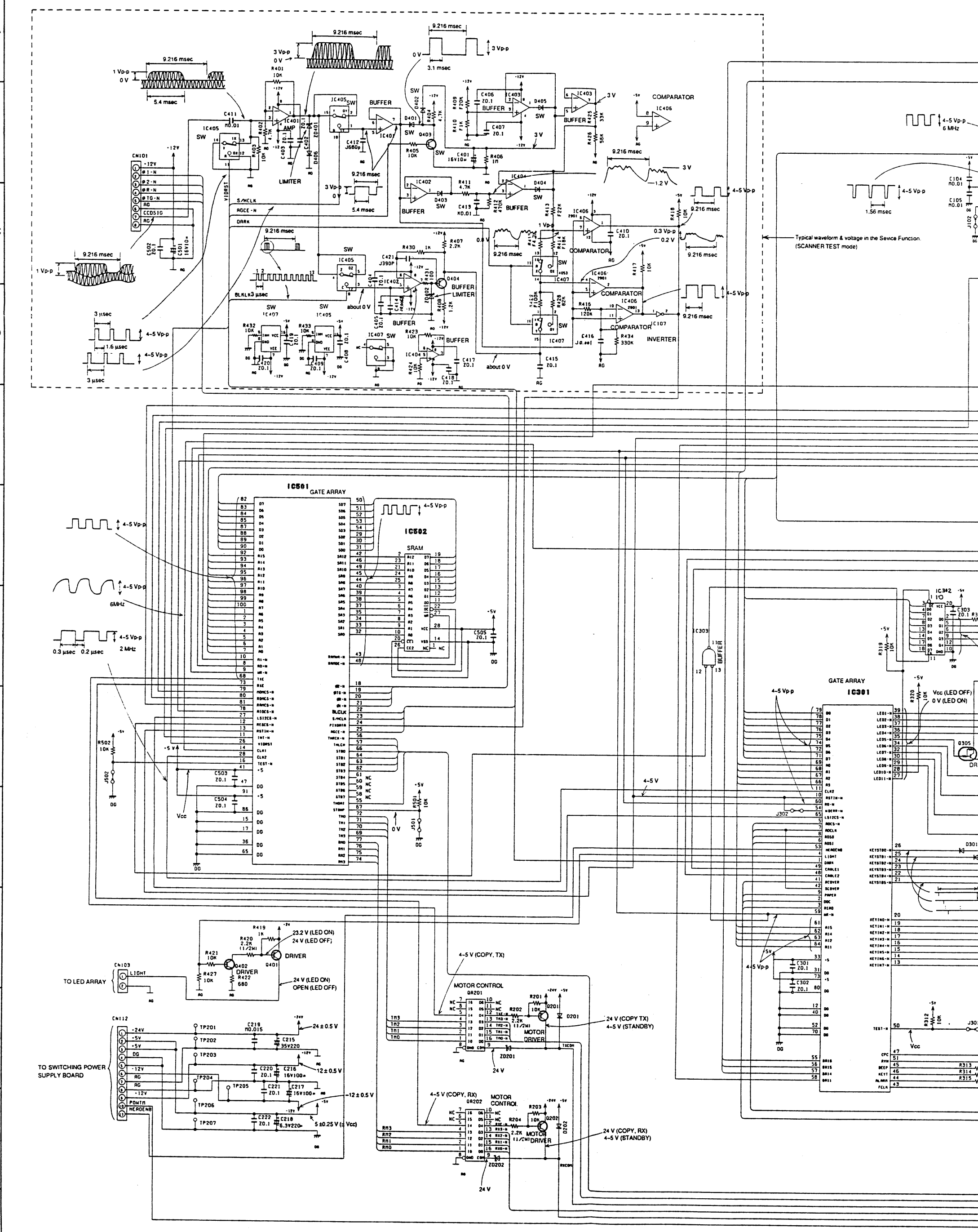
8. **Important safety notice**

   The shaded area on this schematic diagram incorporates special features important for protection from fire and electrical shock hazards.
   When servicing it is essential that only manufacturer's specified parts be used for the critical components in the shaded areas of the schematic.

HANDSET
H/S JACK
PROTECTOR
MICRO DECK
MOTOR
PLUNGER
REED SW
HEAD
D25-29: COUNTER CURRENT PREVENTION
Q20-29: DRIVER
GOVERNOR
D32-35 COUNTER CURRENT PREVENTION
MUTE
AMP
ATAS IC11
FILTER
SP
SPOUT
MIC
LIN
LOUT
VOX
OGMPLY
RVN
RST
NOISE ABSORPTION
DRAM
VOICE SYNTHESIZER (OGM LSI) IC5
OPERATION MODE
DIALING MODE
GATE ARRAY IC15
PowerDOWN

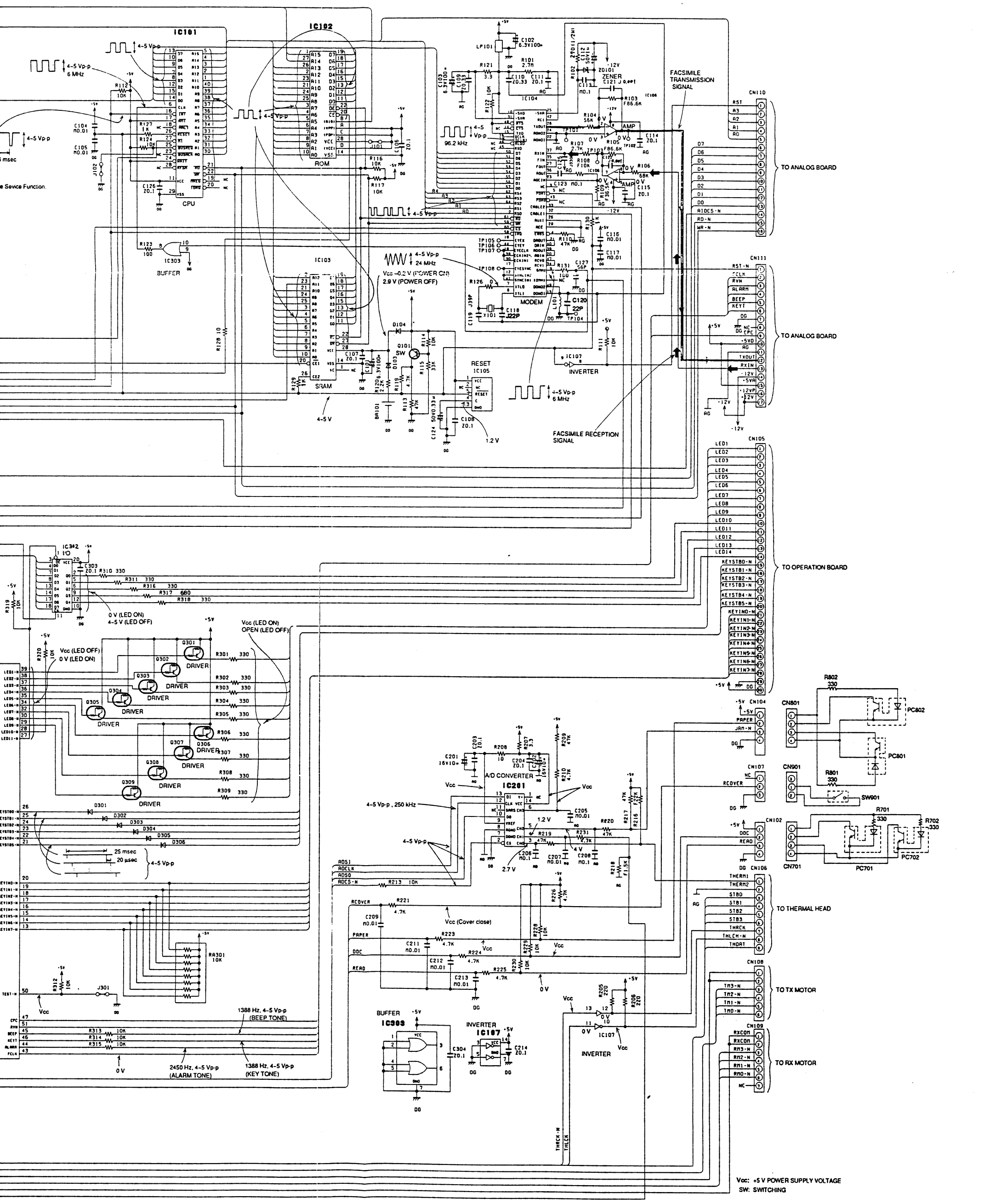
IAGRAM (ANALOG CIRCUIT)




1 2 3 4 5 6 7 8 9 10
A B C D E F G H I J K L M
9.216 msec
1 Vp-p
0 V
5.4 msec
3 Vp-p
3.1 msec
IC405 SW
IC401 AMP
BUFFER
LIMITER
IC407
IC402
IC403
IC404
IC406
COMPARATOR
CN101
+12V
-12V
ø1-N
ø2-N
øR-N
øTG-N
AG
CCDSIG
RG
S/HCLK
AGCE-N
DARK
VIDRST
BLKLNG 3 µsec
about 0 V
3 µsec
1.6 µsec
4-5 Vp-p
6 MHz
1.56 msec
Typical waveform & voltage in the Sevice Function.
(SCANNER TEST mode)
IC501
GATE ARRAY
IC502
SRAM
6MHz
0.3 µsec
0.2 µsec
2 MHz
IC303
BUFFER
IC302
I/O
IC301
GATE ARRAY
Vcc (LED OFF)
0 V (LED ON)
4-5 V
J302
J303
J501
J502
Vcc
TO LED ARRAY
CN103
LIGHT
23.2 V (LED ON)
24 V (LED OFF)
DRIVER
Q401
Q402
TO SWITCHING POWER
SUPPLY BOARD
CN112
+24V
+5V
DG
-12V
AG
PDWTN
HEADENB
TP201
TP202
TP203
TP204
TP205
TP206
TP207
24 ± 0.5 V
12 ± 0.5 V
-12 ± 0.5 V
5 ±0.25 V (= Vcc)
4-5 V (COPY, TX)
MOTOR CONTROL
QA201
MOTOR DRIVER
Q201
ZD201
24 V (COPY TX)
4-5 V (STANDBY)
24 V
4-5 V (COPY, RX)
QA202
Q202
ZD202
24 V (COPY, RX)
4-5 V (STANDBY)
KEYST0-N
KEYST1-N
KEYST2-N
KEYST3-N
KEYST4-N
KEYST5-N
KEYIN0-N
KEYIN1-N
KEYIN2-N
KEYIN3-N
KEYIN4-N
KEYIN5-N
KEYIN6-N
KEYIN7-N
TEST-N
Vcc

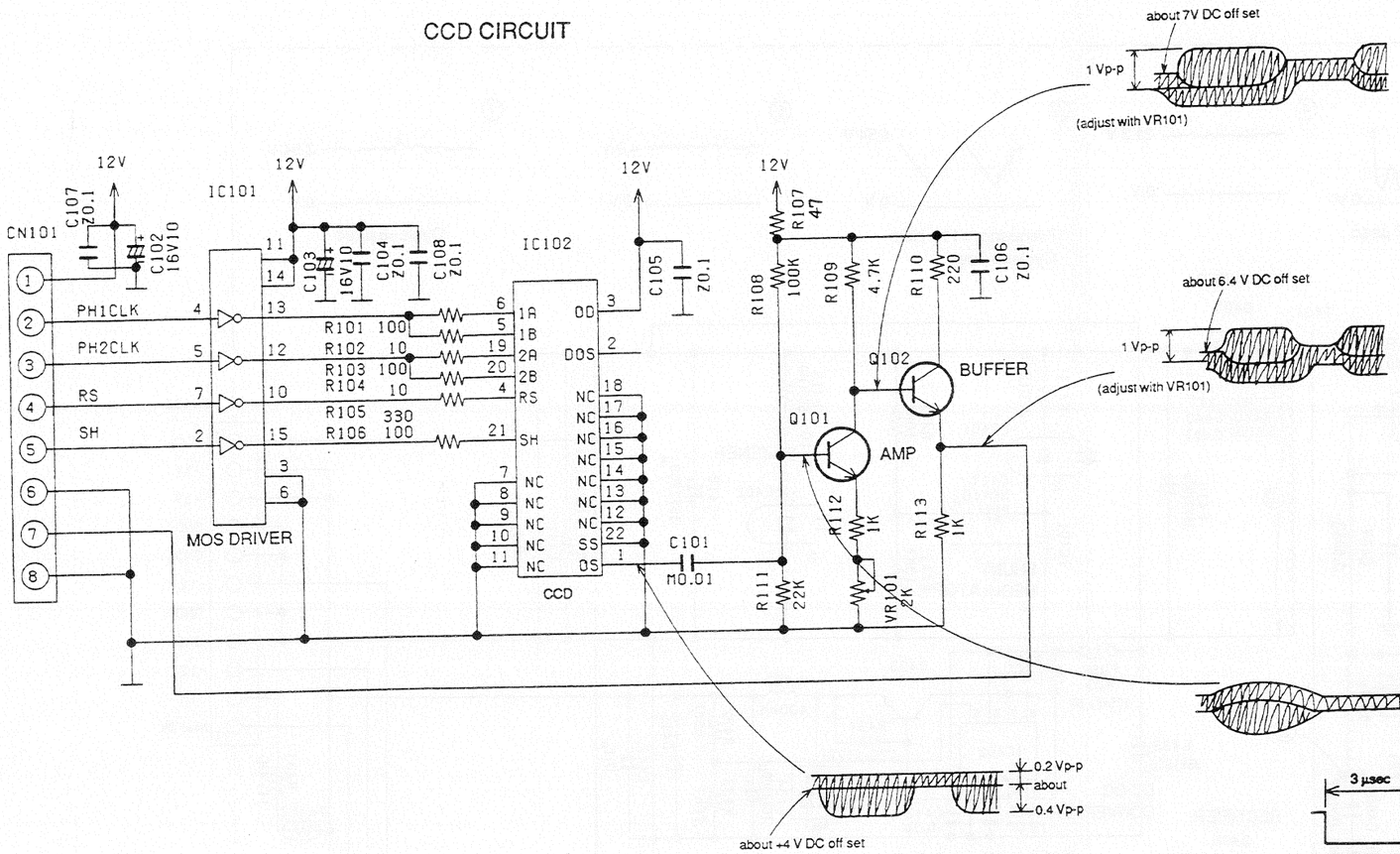
GRAM (DIGITAL CIRCUIT)

10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18

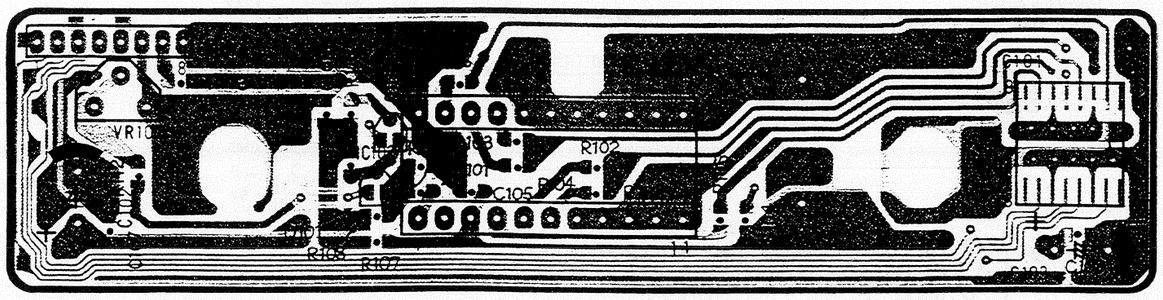


SCHEMATIC DIAGRAM AND PRINTED CIRCUIT BOARD

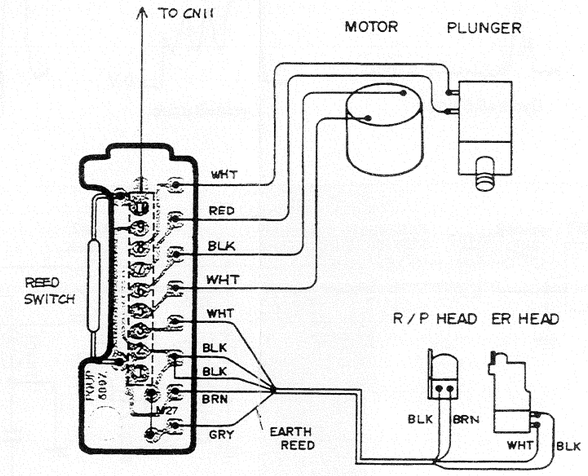
CCD CIRCUIT



CCD BOARD (COMPONENT VIEW)



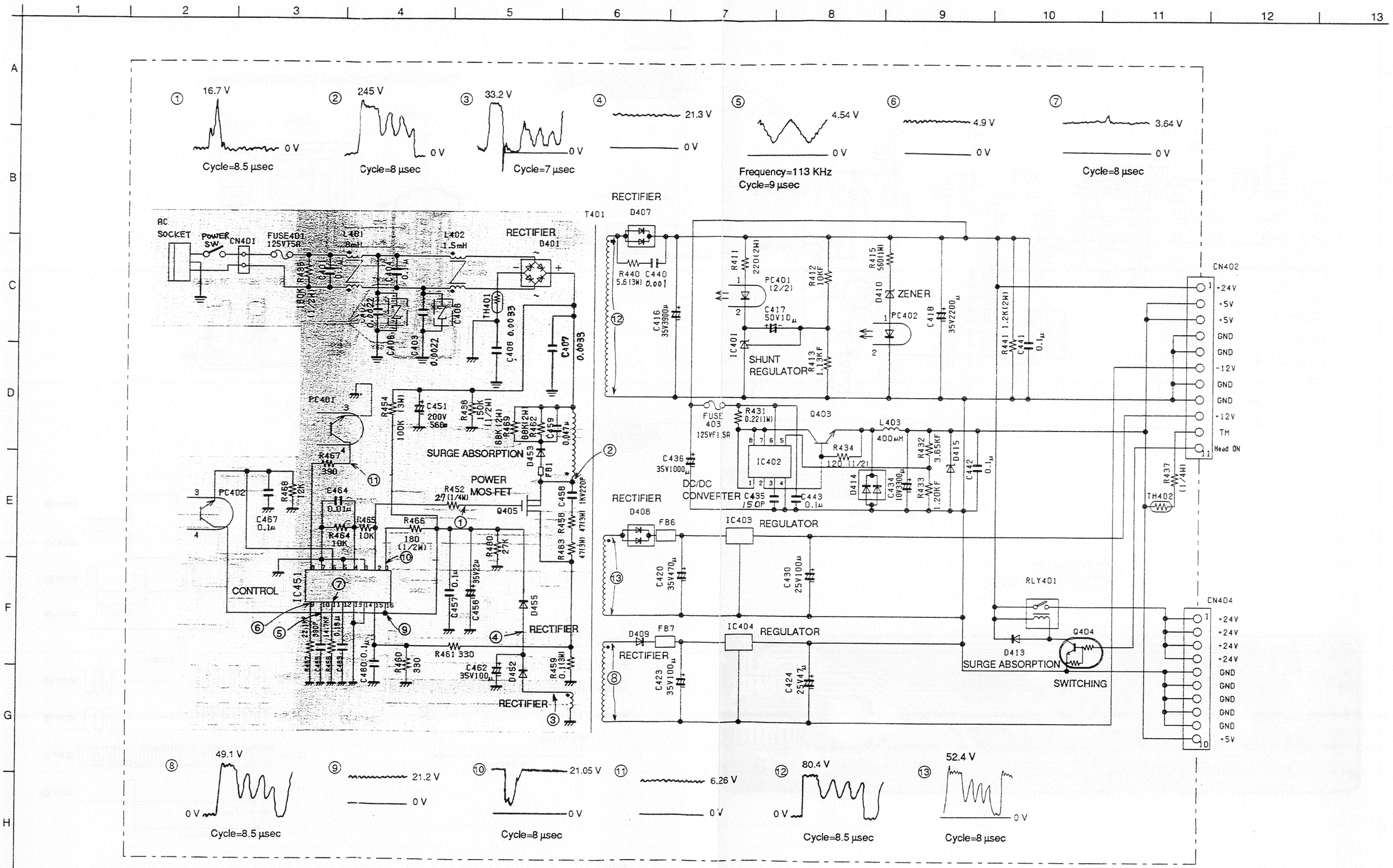
CASSETTE DECK BOARD (COMPONENT VIEW)



Notes:

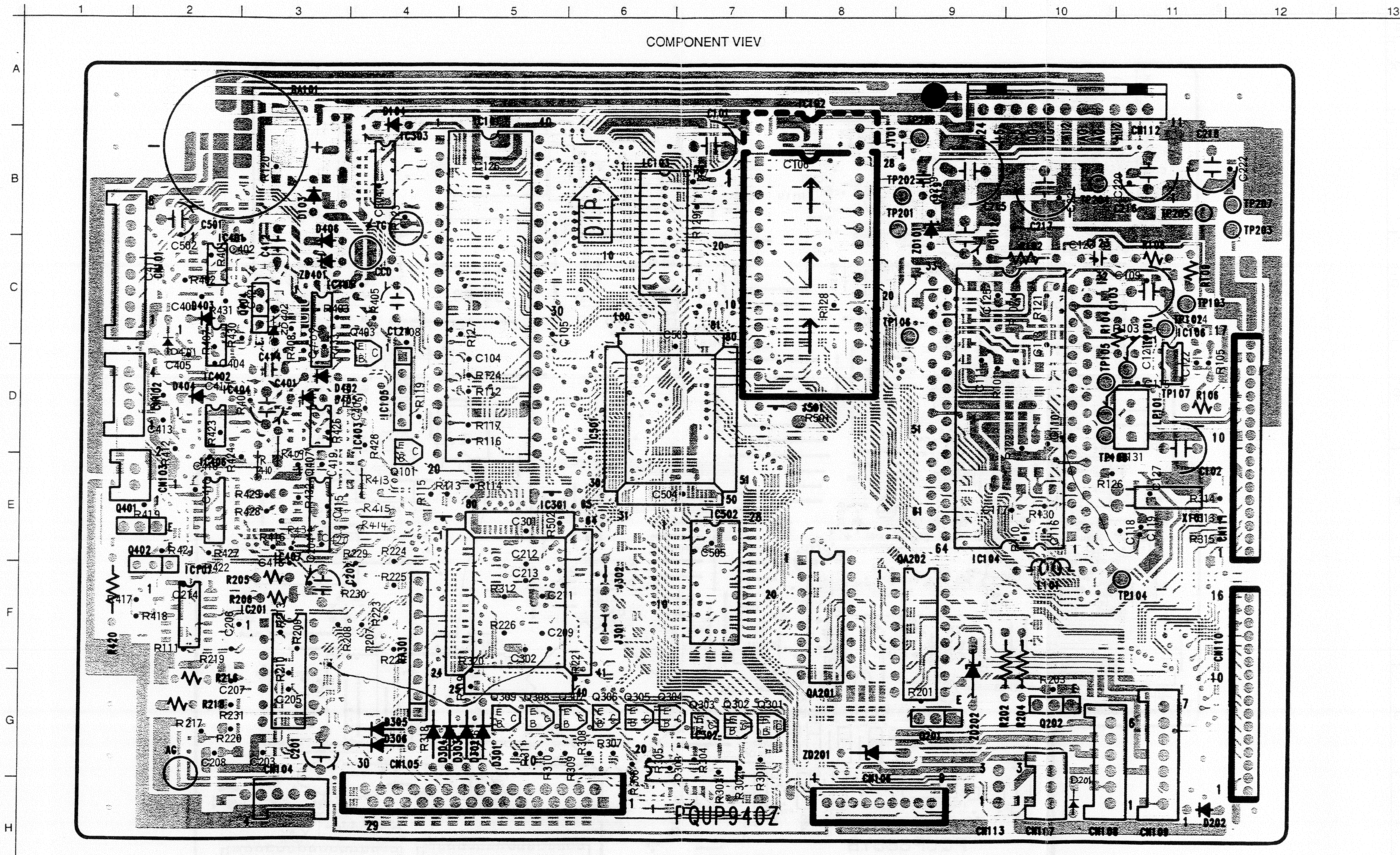
1. The circuit shown in ▨ on the conductor indicates printed circuit on the back side of the printed circuit board.
2. The circuit shown in □ on the conductor indicates printed circuit on the front side of the printed circuit board.

SCHEMATIC DIAGRAM (SWITCHING POWER SUPPLY)



Note:
When measuring the waveform on the primary circuit of the Switching Power Supply Board, be sure to insulate the ground of the oscilloscope's probe from the ground of its power supply.

PRINTED CIRCUIT BOARD (DIGITAL BOARD)


COMPONENT VIEV
1
2
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8
9
10
11
12
13
A
B
C
D
E
F
G
H
IC101
IC102
IC103
IC104
IC106
IC201
IC301
IC303
IC401
IC402
IC404
IC407
CN101
CN102
CN103
CN104
CN105
CN106
CN108
CN109
CN110
CN111
CN112
CN113
CN117
Q101
Q201
Q202
Q301
Q302
Q303
Q304
Q305
Q306
Q307
Q308
Q309
Q401
Q402
Q403
QA201
QA202
D101
D103
D201
D202
D301
D302
D303
D304
D305
D306
D401
D402
D403
D404
D405
D406
ZD101
ZD201
ZD202
ZD401
ZD402
TP101
TP102
TP103
TP104
TP105
TP106
TP107
TP201
TP202
TP203
TP204
TP205
TP207
LP101
L101
X101
J301
J302
J501
RA101
RA301
C104
C105
C106
C109
C118
C119
C122
C126
C202
C205
C207
C208
C209
C211
C212
C213
C214
C216
C217
C218
C219
C220
C222
C225
C301
C302
C401
C402
C405
C413
C415
C419
C420
C501
C502
C504
C505
C506
R102
R103
R104
R105
R106
R108
R109
R111
R112
R113
R114
R115
R116
R117
R119
R120
R121
R124
R126
R127
R128
R129
R130
R131
R201
R202
R203
R204
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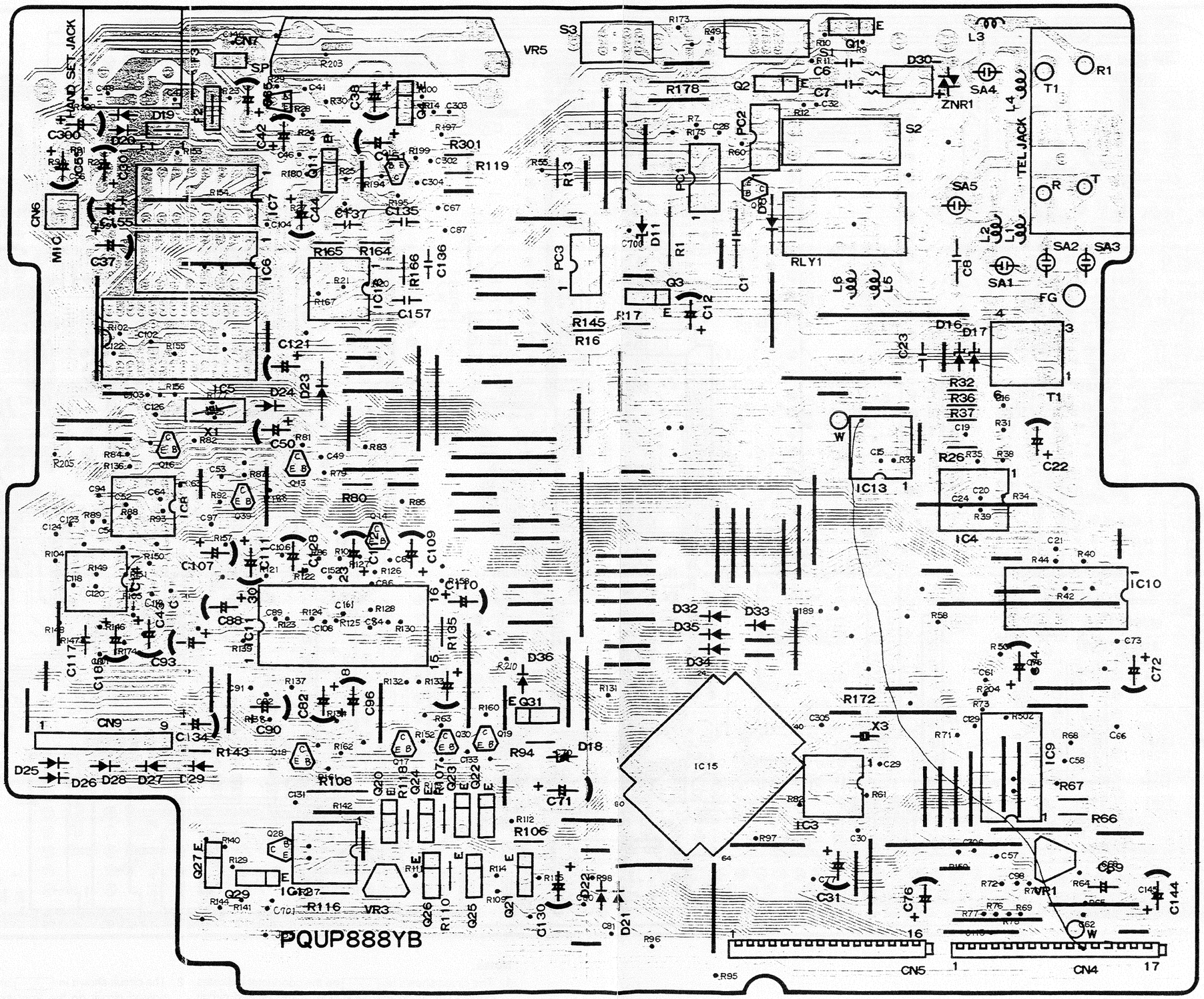
R206
R208
R209
R210
R217
R218
R219
R220
R223
R224
R225
R226
R229
R230
R231
R301
R302
R303
R304
R305
R306
R307
R308
R309
R310
R312
R314
R315
R318
R320
R321
R402
R405
R409
R410
R413
R414
R415
R416
R417
R418
R419
R420
R421
R422
R423
R424
R425
R426
R427
R428
R429
R430
R431
R501
R502
D.I.P.
FQUP9407
AG

Notes:

1. The circuit shown in ▭ on the conductor indicates printed circuit on the back side of the printed circuit board.
2. The circuit shown in ▭ on the conductor indicates printed circuit on the front side of the printed circuit board.

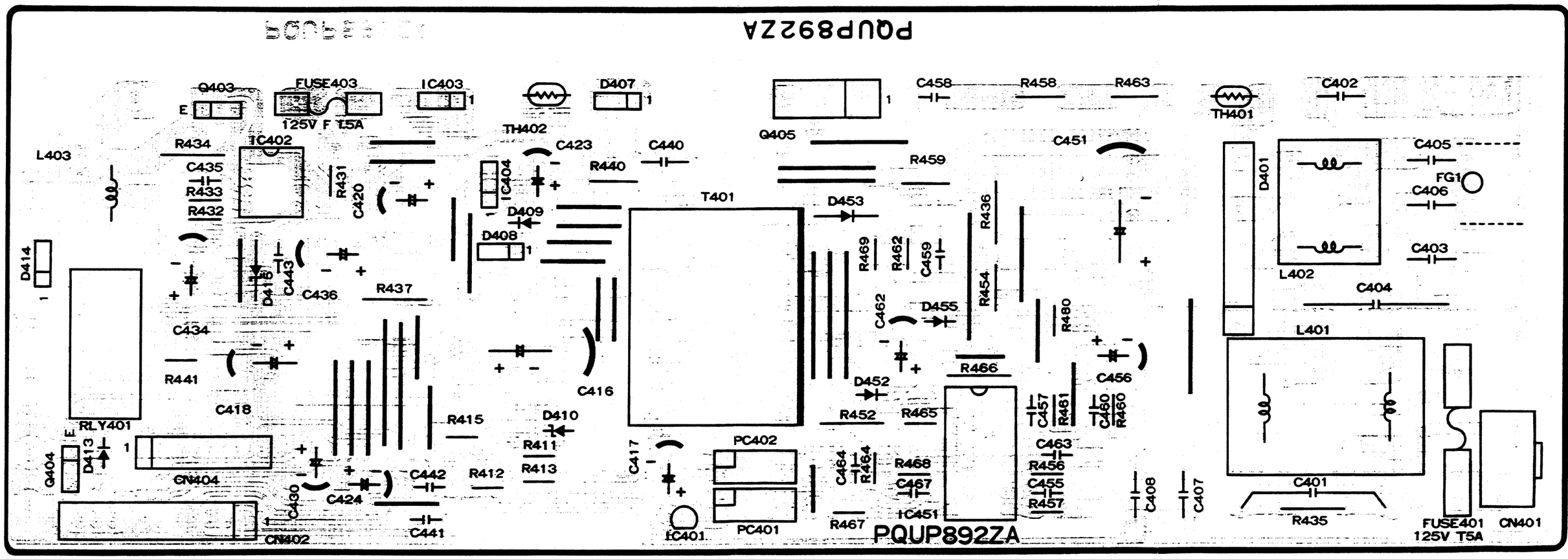
PRINTED CIRCUIT BOARD (ANALOG BOARD)

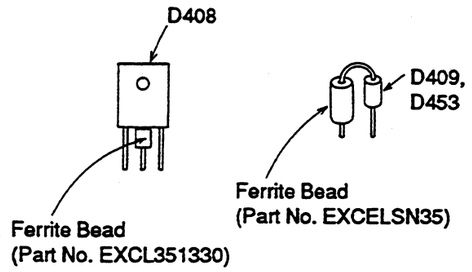
COMPONENT VIEW



PRINTED CIRCUIT BOARD (SWITCHING POWER SUPPLY)

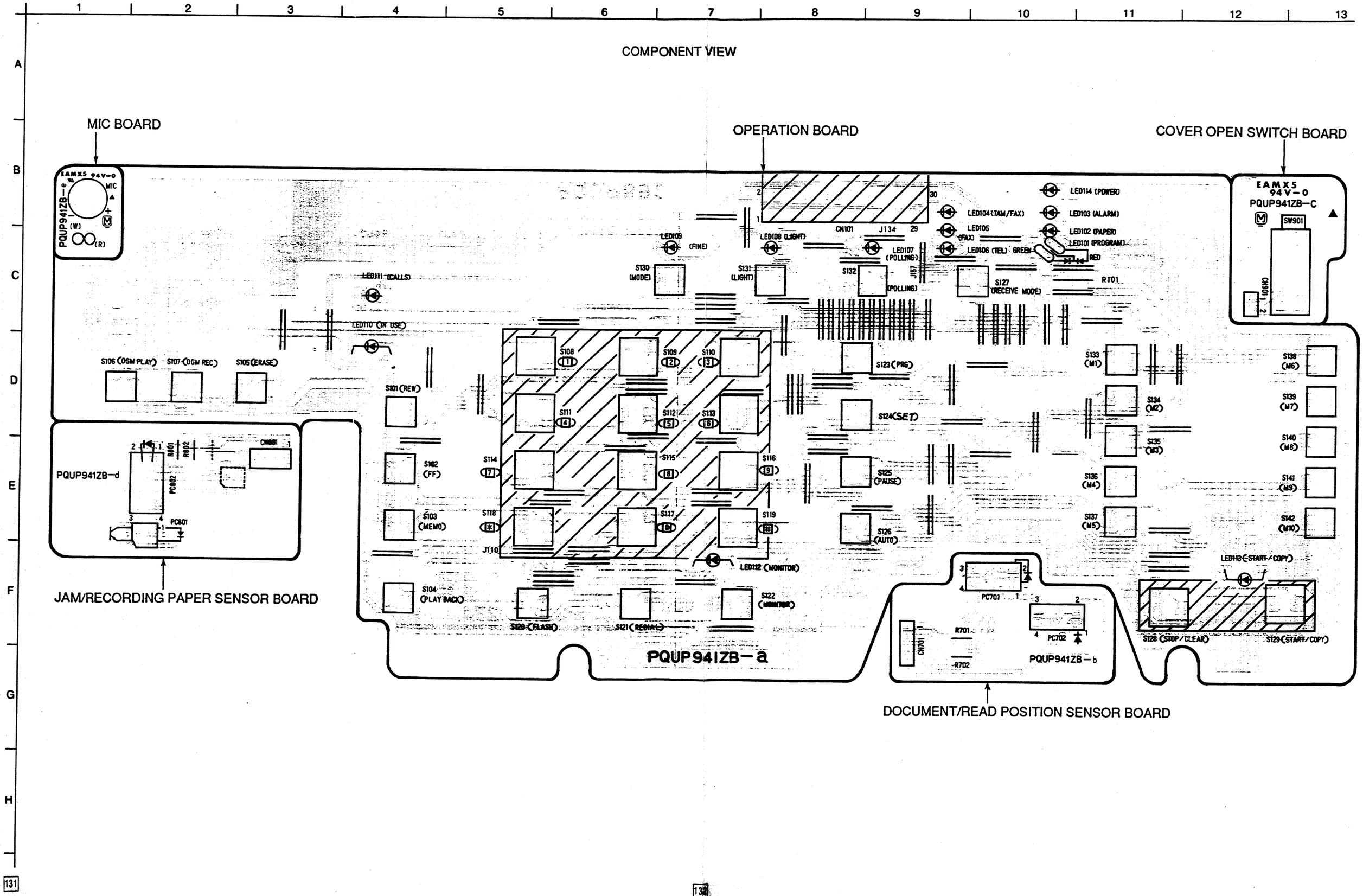
COMPONENT VIEW



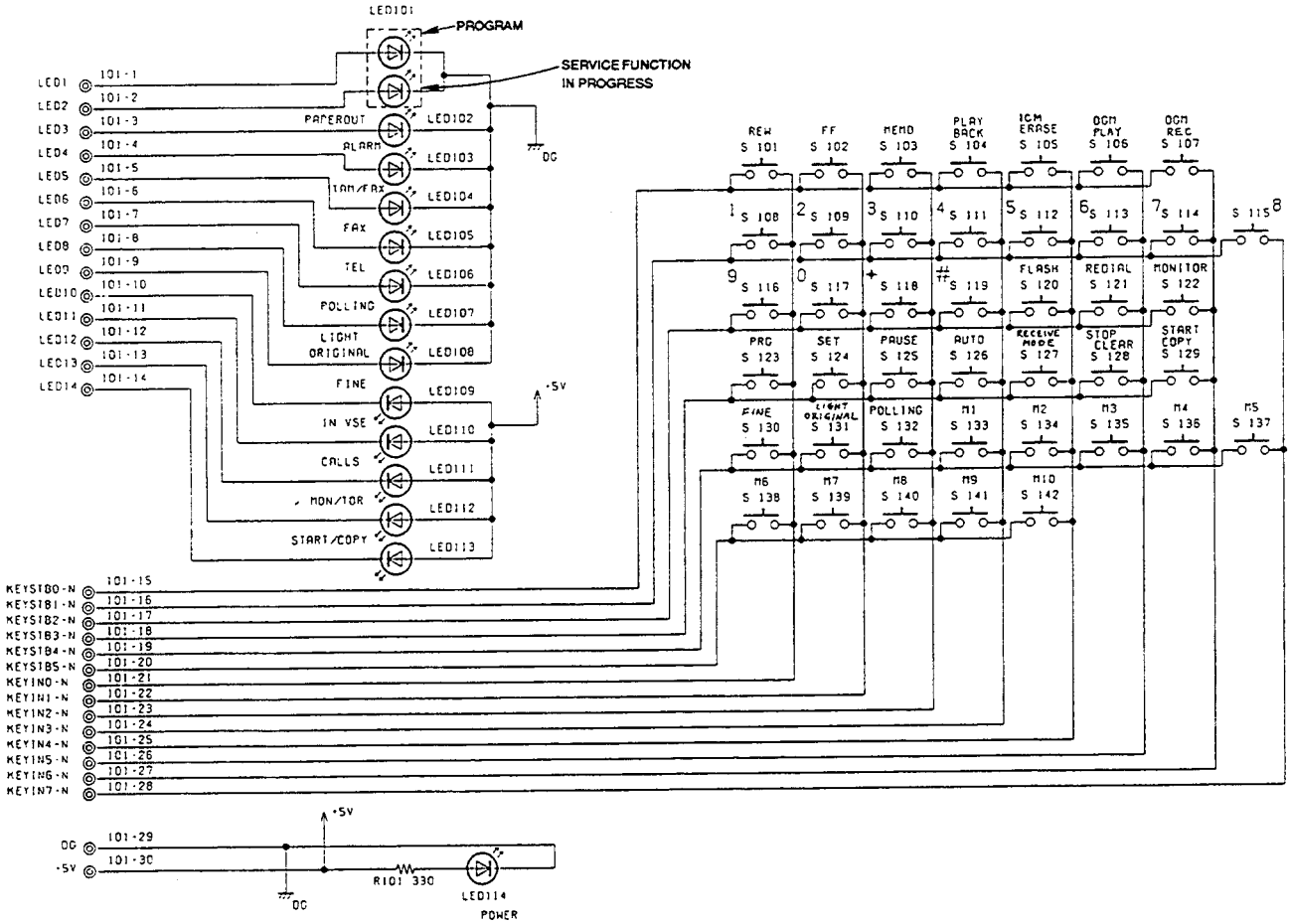


PRINTED CIRCUIT BOARD (OPERATION BOARD)

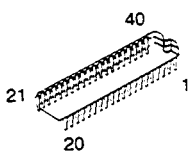
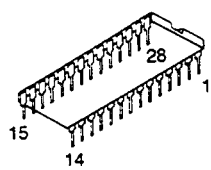
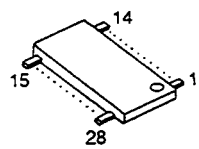
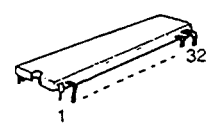
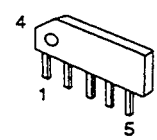
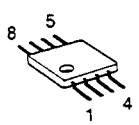
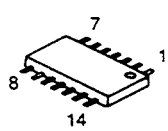
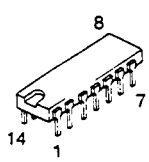
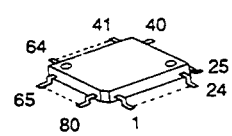
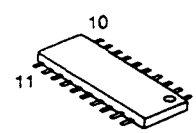
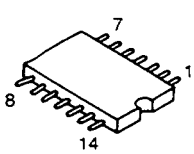
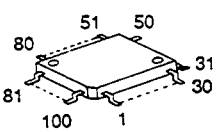
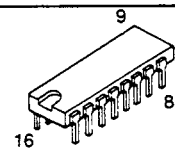
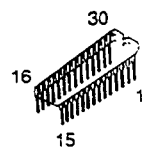
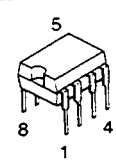
COMPONENT VIEW

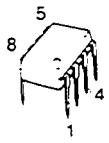
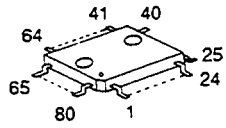
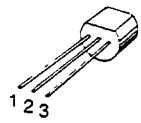
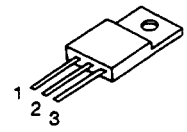
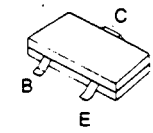
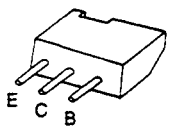
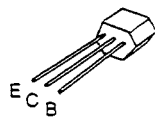
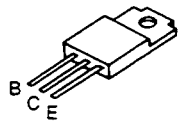
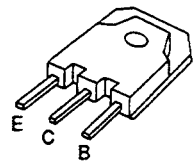
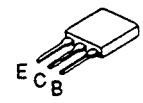
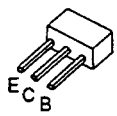
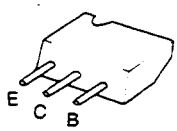
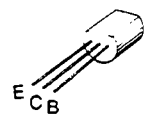
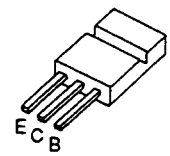
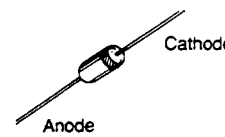
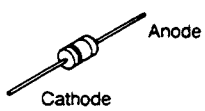
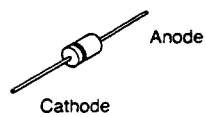
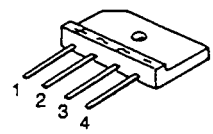
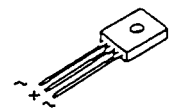
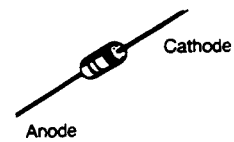
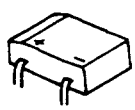
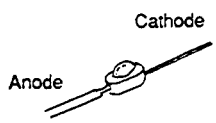
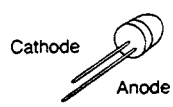


SCHEMATIC DIAGRAM (OPERATION CIRCUIT)

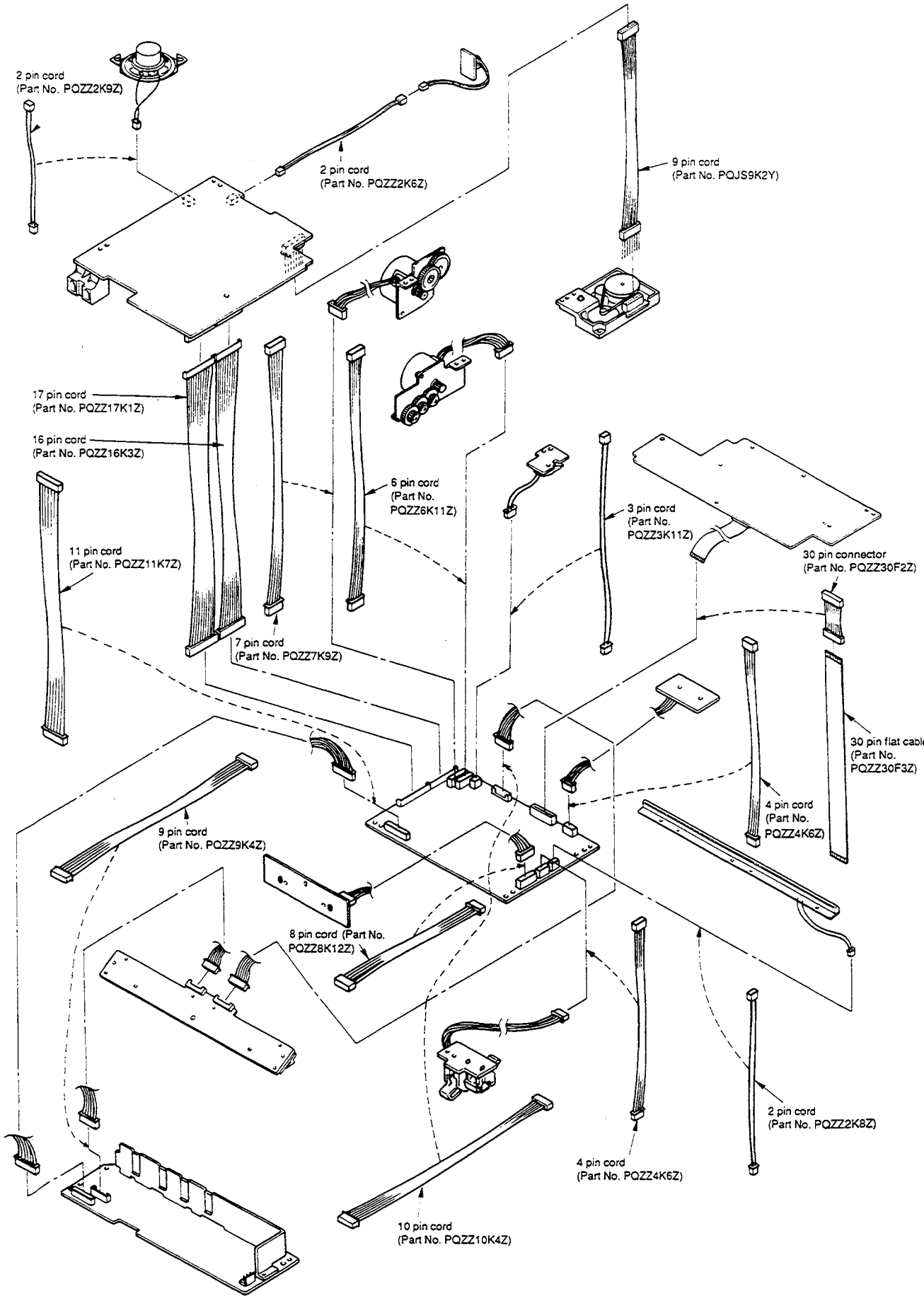


TERMINAL GUIDE OF IC'S, TRANSISTORS AND DIODES

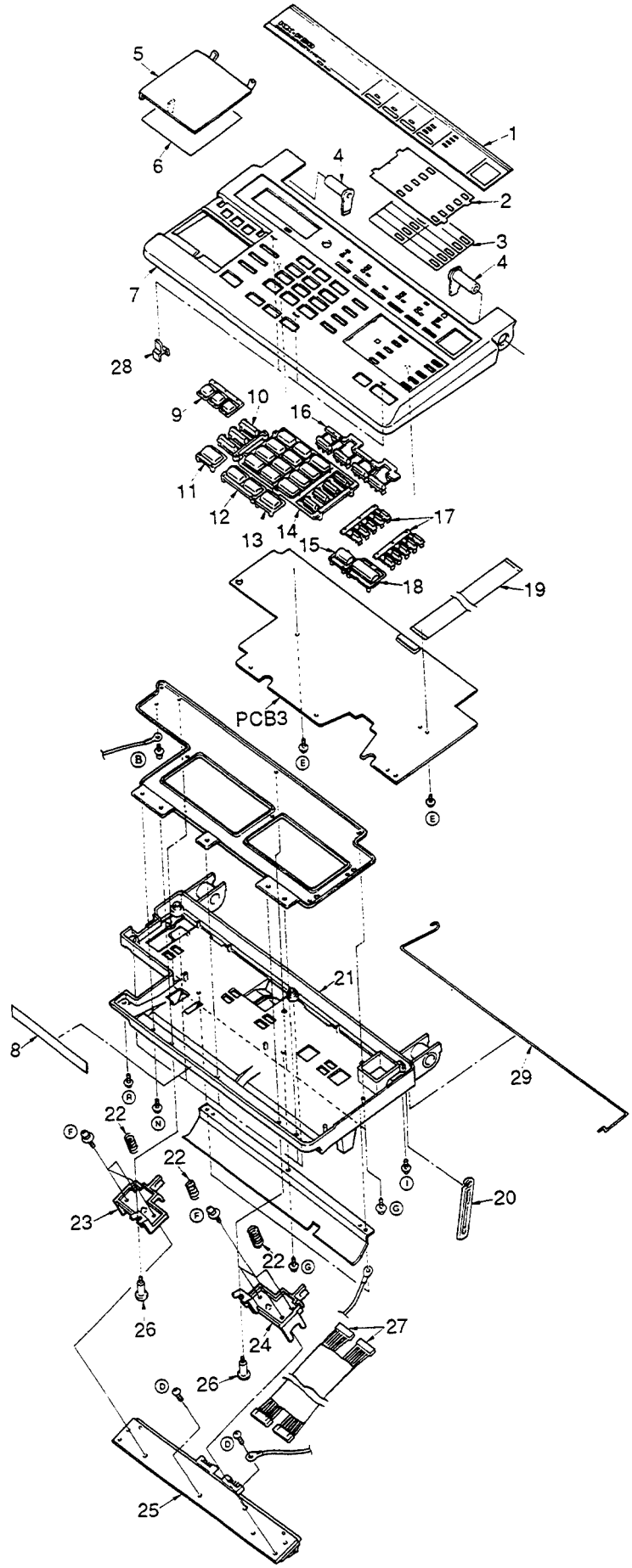
 PQVIZ8400P6G	 PQVITMS3477 PQWIF50M	 PQVIM5165FCL	 PQVIR96MFX	 PQVIM5195BL
 PQVINJM082BM PQVINJM4558M	 PQVINJM2901M PQVISN7H32S PQVISN7L06S	 PQVIPD4066BC PQVIDC0834CN	 PQVIE15R20F	 PQVISN7L374S
 PQVITC4053BF	 PQVIE22R76F	 PQVIM51977P PQVITM41256A PQVINJ4053BD PQVIBA12003	 AN6181K	 PQVIM3074AE1 PQVIBA6220

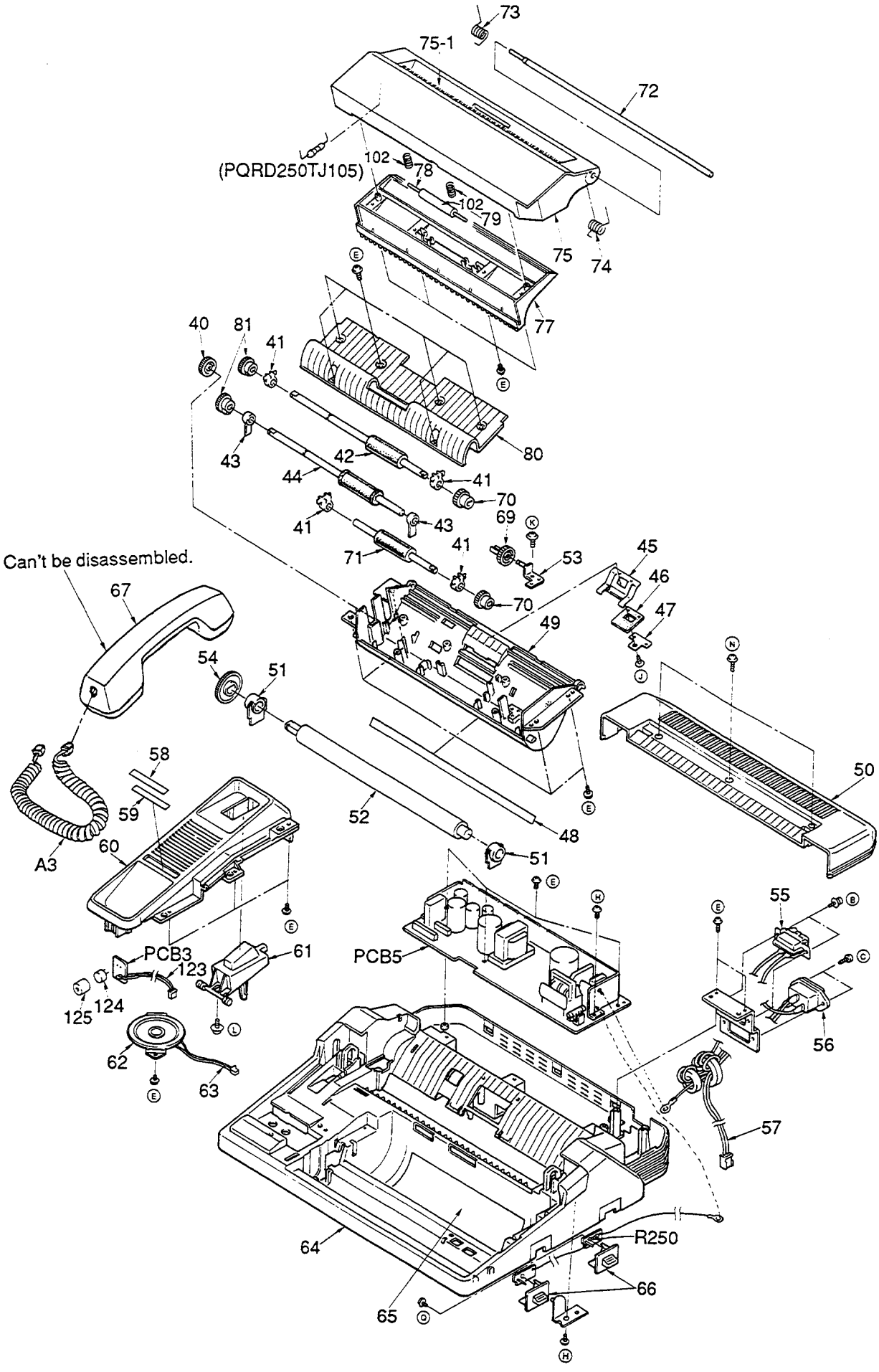
 PQVINJ2360D PQVINJM4558D	 PQVI672191F	 PQVIUPC1093J	 PQVITA7812AP	 PQVTDTC143E PQVTDTA114YU, 2SB1218A, 2SD1819A
 2SC1652 2SB1322, 2SD1994A	 PQVTDTC143XS 2SC1740S, 2SA933	 2SD1266	 2SK1488	 2SA1626
 PQVTBB1A4A	 2SD662B	 2SC2235	 2SD2136	 PQVDHZS3A1, 1SS131, MA700A
 MA7200 1SS147, MA4270	 PQVD1GU42, PQVD1JU41 1S1588	 PQVDD5SBA40S	 PQVDD5LC20U PQVDD10LC20U	 MA4068 MA4039, MA4056 MA7062, MA4051
 PQVDS1YB40F1	 PQVDGL1E11C PQVDGL1D11E	 LN38GP LN28RPXTA3 LN086WP38		

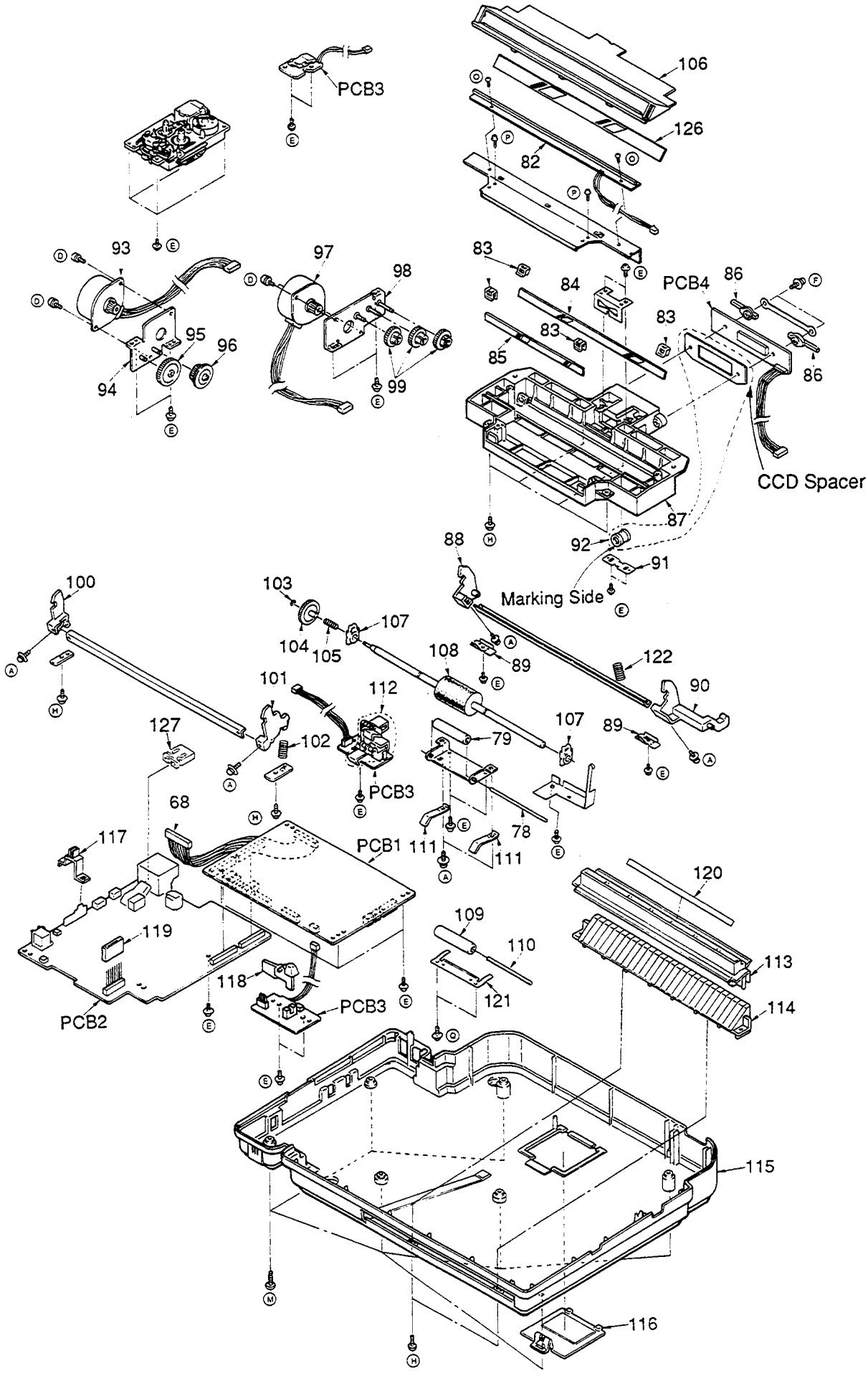
CONNECTOR LEAD AND EXTENSION CORD CONNECTING METHOD

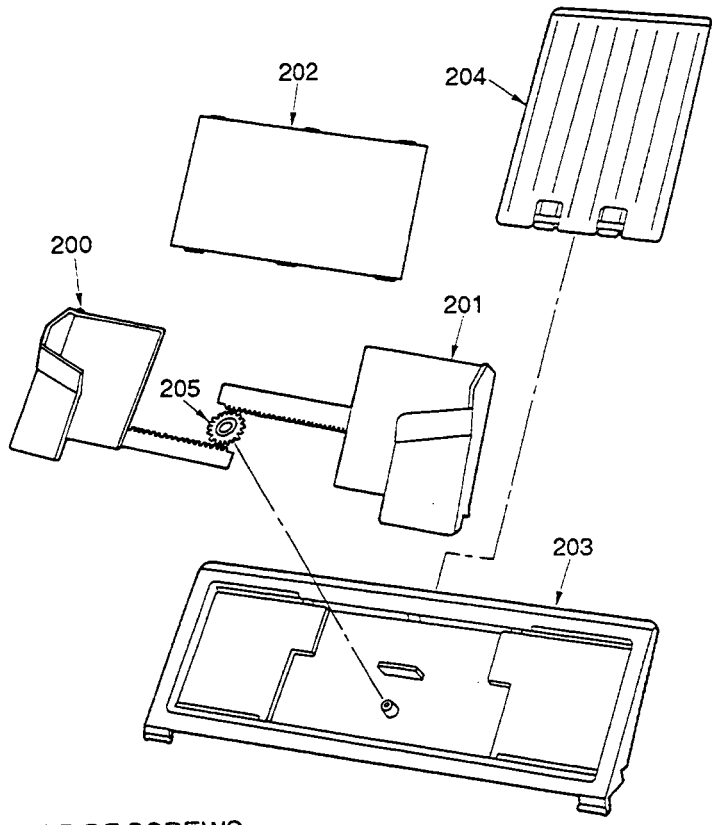


CABINET, MECHANICAL AND ELECTRICAL PARTS LOCATION

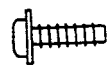
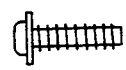
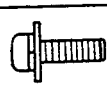
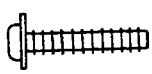



73
75-1
72
(PQRD250TJ105)
102
78
102
79
75
74
77
40
81
41
43
42
44
41
70
41
43
69
71
41
53
45
46
47
70
49
Can't be disassembled.
67
54
51
58
59
60
A3
52
48
51
50
PCB3
123
61
125
124
62
63
PCB5
55
56
57
64
R250
66
65

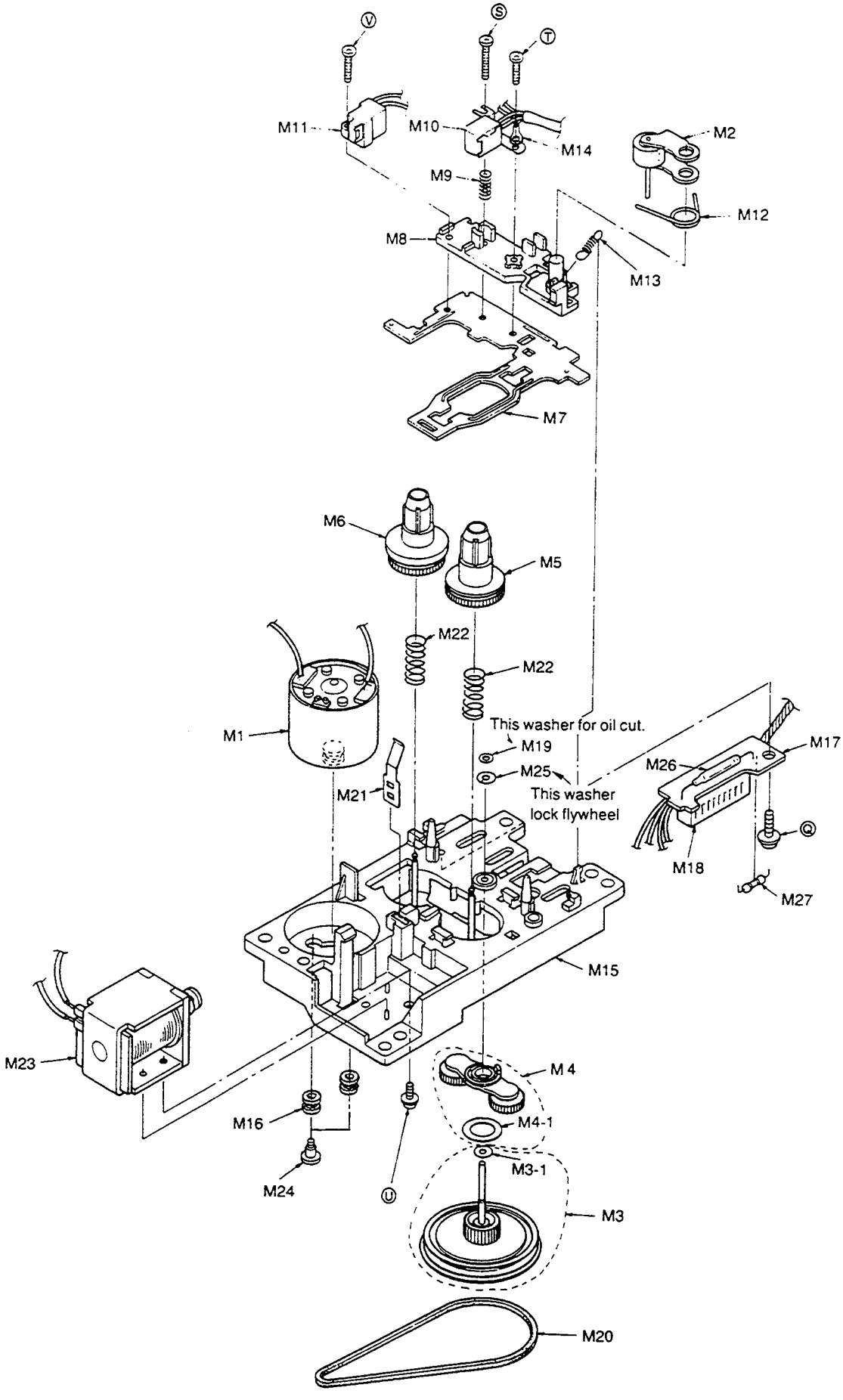

PCB3
106
126
82
93
97
98
83
84
PCB4
86
83
85
95
96
94
99
CCD Spacer
87
88
92
91
Marking Side
100
103
107
104
105
108
89
122
90
101
112
127
102
79
107
89
PCB3
68
117
PCB1
111
78
120
109
110
119
118
121
113
114
PCB3
PCB2
115
116



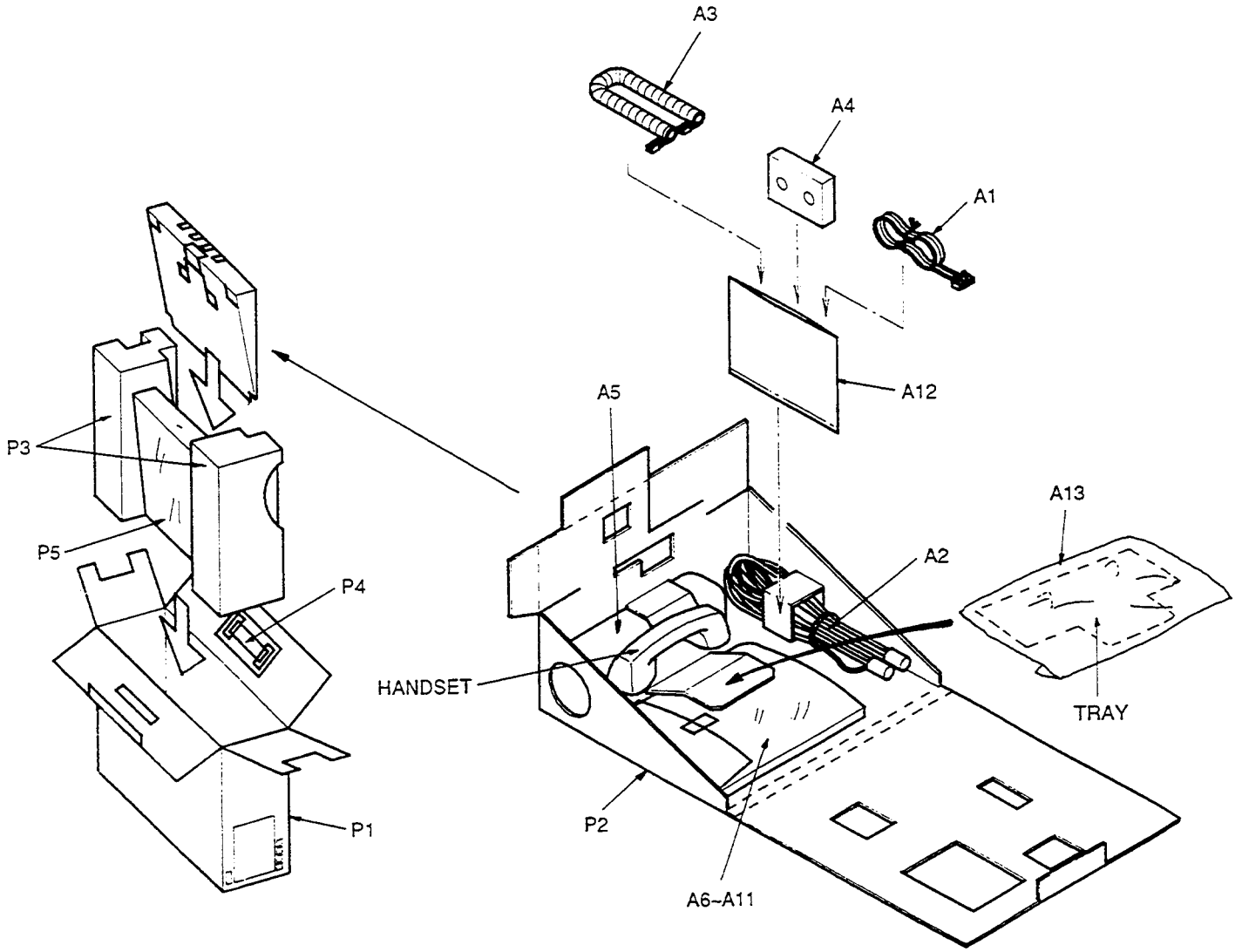
ACTUAL SIZE OF SCREWS

Ref. No.	Figure	Part No.	Ref. No.	Figure	Part No.
Ⓐ		XYN3+F6	Ⓛ		PJHE5065Z
Ⓑ		XYN3+C6	Ⓜ		XTW3+S14P
Ⓒ		XSS3+6	Ⓝ		XTW3+S10PFZ
Ⓓ		XYN3+C4	Ⓞ		XSN26+4
Ⓔ		XTW3+S8M	Ⓟ		XTW3+S12M
Ⓕ		XYN3+F10	Ⓠ		XTW26+6F
Ⓖ		XYN3+F8	Ⓡ		XTB3+8GFZ
Ⓗ		XTW3+S10M	Ⓢ		XSN17+10FN-3
Ⓘ		XTW3+S16M	Ⓣ		XSN17+6FZ-3
Ⓙ		XTS26+6C	Ⓤ		XTW26+5LF
Ⓚ		XTW3+S6P	Ⓥ		XSN17+7FN-3

CASSETTE DECK PARTS LOCATION



ACCESSORIES AND PACKING MATERIALS



REPLACEMENT PARTS LIST

Model KX-F50

Notes:

1. Printed circuit board assembly with mark (NLA) is no longer available after production discontinuation of the complete set.
2. Important safety notice.
   Components identified by the ⚠ mark special characteristics important for safety. when replacing any of these components, use only manufacture's specified parts.
3. The S mark indicates service standard parts and may differ from production parts.
4. RESISTORS & CAPACITORS
   Unless otherwise specified.
   All resistors are in ohms(Ω) k=1000Ω,M=1000kΩ
   All capacitors are in MICRO FARADS(μF) P=μμF
   *Type &Wattage of Resistor
   Type

ERC:Solid	ERX:Metal Film	PQ4R:Carbon
ERD:Carbon	ERG:Metal Oxide	ERS:Fusible Resistor
PQRD:Carbon	ER0:Metal Film	ERF:Cement Resistor

Wattage

10,16:1/8W	14,25:1/4W	12:1/2W	1:1W	2:2W	3:3W

*Type & Voltage of Capacitor
Type

ECFD:Semi-Conductor	ECCD,ECKD,ECBT,PQCBC : Ceramic
ECQS:Styrol	ECQE,ECQV,ECQG : Polyster
PQCUV:Chip	ECEA,ECSZ : Electrolytic
ECQMS:Mica	ECQP : Polyproplylene

Voltage

ECQ Type	ECQG ECQV Type	ECSZ Type	Others	
1H: 50V	05: 50V	0F:3.15V	0J :6.3V	1V :35V
2A:100V	1:100V	1A:10V	1A :10V	50,1H:50V
2E:250V	2:200V	1V:35V	1C :16V	1J :63V
2H:500V		0J:6.3V	1E,25:25V	2A :100V

Ref. No.	Part No.	Part Name & Description	Pcs
		CABINET, MECHANICAL AND ELECTRICAL PARTS	
1	PQGP125Z	PANEL	1
2	PQHR5288Z	TRANSPARENT PLATE, MEMORY CARD	1
3	PQHP5056Z	CARD, MEMORY	1
4	PQDF9031Z	SHAFT, OPERATION GRILLE	2
5	PQKG10Y	CASSETTE LID	1
6	PQQT5150Z	INSTRUCTION LABEL	1
7	PQGG87Y	GRILLE, OPERATION	1
8	PQQT4336Z	CAUTION LABEL-A	1
9	PQBCX171Z	BUTTON, OGM PLAY/REC/ICM EARSE	1
10	PQBCX170Z	BUTTON, REW/FF/MEMO/2WAY	1
11	PQBC260Z	BUTTON, PALYBACK/PAUSE	1
12	PQBCX172Z	BUTTON, FLASH, REDIAL	1
13	PQBC261Z	BUTTON, MONITOR/VOICE STDBY	1
14	PQBCX167Z	BUTTON, DIAL/PRO/SET/PAUSE/AUTO	1
15	PQBC259Z	BUTTON, STOP/CLEAR	1
16	PQBCX169Y	BUTTON, FINE/LIGHT/POLLING/RECE.	1
17	PQBCX168Z	BUTTON, MEMORY	2
18	PQBC258Z	BUTTON, START/COPY	1
19	PQJE109Y	FLAT CABLE	1
20	PQHR9466Z	HOLDER, OPERATION GRILLE	1
21	PQHR9423Z	COVER, OPERATION GRILLE	1
22	PQUS211Z	SPRING, THERMAL HEAD	3
23	PQHR9421Z	LEFT GUIDE, THERMAL HEAD	1
24	PQHR9422Z	RIGHT GUIDE, THERMAL HEAD	1
25	PQJHS9Z	THERMAL HEAD	1
26	PQHE5020Y	SCREW, THERMAL HEAD M*TG	2
27	PQJS19S30Y	CONNECTOR, 19P	1
28	PQGP119Z	LED COVER	3
29	PQUS213Z	SPRING, OPERATION GRILLE COVER	1
40	PQDG5036Z	MIDDLE GEAR-A	1
41	PQHR9426Z	SPACER, FEED ROLLER	4
42	PQDN19Y	ROLLER, DOCUMENT FEED	1
43	PQHR9427Z	SPACER, FEED ROLLER	2
44	PQDN20Y	ROLLER, DOCUMENT DISCHARGE	1
45	PQUS187Y	SPRING, DOCUMENT SEPARARTION	1
46	PQHG827Z	RUBBER, DOCUMENT SEPARATION	1
47	PQHM117Z	METAL, SEPARATION RUBBER M*TG	1
48	PQHR5289Z	READING PLATE	1
49	PQZMF50M	DOCUMENT GUIDE-A ASS'Y	1
50	PQUV104Y	REAR COVER	1
51	PQHR9424Z	SPACER, THERMAL PLATEN	2
52	PQDN17Z	THERMAL PLATEN	1
53	PQMD9021Z	GEAR CHASSIS-A	1
54	PQDG5037Z	GEAR, PLATEN	1
55	EST15704V	SWITCH, POWER ⚠	1
56	PQJP3A2Z	AC SOCKET ⚠	1
57	PQJS2L94Z	CONNECTOR, 2P ⚠	1
58	PQHR576Z	TRANSPARENT PLATE, TEL. NO. CARD	1
59	PQHP532X	CARD, TEL. NO.	1
60	PQKM195Y	CABINET BODY, HANDSET CRADLE	1
61	PQBE32Y	BUTTON, HOOK	1
62	PQAS5P05Z	SPEAKER	1
63	PQJS2L93Z	CONNECTOR, 2P	1
64	PQYMF50M	UPPER CABINET ASS'Y	1
65	PQQT4335Z	CAUTION LABEL-B	1
66	PQBD163Z	KNOB, FRONT/BACK LID OPEN	2
67	PQJX2PM409Z	HANDSET ASS'Y	1
68	PQJS11M34Z	CONNECTOR, 11P	1
69	PQDG5043Z	MIDDLE GEAR-B	1
70	PQDG5044Z	GEAR, RECORDING PAPER FEED	2
71	PQDN21Y	ROLLER, DOCUMENT FEED	1
72	PQDF9028Z	SHAFT, DOCUMENT LID	1
73	PQUS219Y	SPRING, DOCUMENT LID (LEFT)	1
74	PQUS221Y	SPRING, DOCUMENT LID (RIGHT)	1
75	PQYEF50M	DOCUMENT LID	1
75-1	PQJE113Z	BRUSH-A	1
76	Not Used		
77	PQHR9428Z	DOCUMENT GUIDE, UPPER SIDE	1
78	PQDF9029Z	SHAFT, SUB ROLLER	2
79	PQDR16Z	SUB ROLLER-A	2
80	PQHR9445Y	DOCUMENT GUIDE-B	1
81	PQDG5038Z	GEAR, RECORDING PAPER FEED	2
82	LN803184UN	LED ARRAY	1
83	PQUS216Z	SPRING, MIRROR M*TG	4
84	PQ0M3Z	MIRROR -A (LONG)	1
85	PQ0M4Z	MIRROR-B (SHORT)	1
86	PQHR9429Z	LEVER, CCD ADJUSTMENT	2
87	PQZEF50M	CCD CHASSIS	1
88	PQHR9419Z	LOCK LEVER-L	1
89	PQUS208Z	SPRING, LOCK LEVER	2
90	PQHR9420Z	LOCK LEVER-R	1
91	PQUS217Z	SPRING, LENS M*TG	1
92	PQWEF50M	LENS (WITH SPACER)	1
93	PQJQ26Z	MOTOR, RECEPTION	1
94	PQMD9014Z	GEAR CHASSIS-B	1
95	PQDG5035Z	MIDDLE GEAR-B	1
96	PQDG5034Z	MIDDLE GEAR-C	1
97	PQJQ27Z	MOTOR, TRANSMISSION	1
98	PQMD9013Z	GEAR CHASSIS-C	1
99	PQDG5033Z	MIDDLE GEAR-D	3
100	PQHR9417Z	LOCK LEVER, LEFT	1
101	PQHR9418Z	LOCK LEVER, RIGHT	1
102	PQUS207Y	SPRING, RIGHT LOCK LEVER, ROLLER	3
103	XUC2FY	RETAINING RING	1
104	PQDG5039Z	GEAR, SEPARATION	1
105	PQUS215Z	SPRING, SEPARATION ROLLER	1
106	PQUV103Y	COVER	1
107	PQHR9425Z	SPACER, SEPARARION ROLLER	2
108	PQDN18Z	ROLLER, DOCUMENT SEPARATION	1
109	PQDR17Z	SUB ROLLER-B	1
110	PQDF9042Z	SHAFT, SUB ROLLER-B	1
111	PQUS209Z	SPRING, SUB ROLLER-A M*TG	2
112	PQHR9539Z	LEVER, SENSOR	1
113	PQHR9489Z	UPPER GUIDE, RECORDING PAPER	1
114	PQHR9490Z	LOWER GUIDE, RECORDING PAPER	1
115	PQYFF50M	LOWER CABINET	1
116	PQKE55Z1	ROM LID	1
117	PQBD162Z	KNOB, VOLUME	1
118	PQHR9416Y	LEVER, RECORDING PAPER DET.	1
119	PQHR9510Z	SPACER, DECK CONNECTOR	1
120	PQQT4337Z	CAUTION LABEL-C	1
121	PQZSF50M	SPRING ASS'Y, SUB ROLLER-B M*TG	1
122	PQUS228Z	SPRING, LOCK LEVER	1
123	PQJS2L96Z	CONNECTOR,2P	1
124	PQJM120Z	MICROPHONE	1
125	PQHG503Z	RUBBER PARTS, MIC COVER	1

Ref. No.	Part No.	Part Name & Description	Pcs
126	PQ0G2Z	GLASS	1
127	PQHR9451Z	SPACER, HOOK SWITCH	1
200	PQHR9410Z	SLIDER-L	1
201	PQHR9411Z	SLIDER-R	1
202	PQHR9412Y	COVER,SLIDER	1
203	PQKE71Y	TRAY (LARGE)	1
204	PQKE72Y	TRAY (SMALL)	1
205	PQDG5042Z	GEAR	1
R250	PQRD250TJ105	RESISTOR, 1MΩ	1
		CASSETTE DECK PARTS	
M1	PQFM9909Z	MOTOR ASS'Y	1
M2	PQFD9913Z	PINCH ROLLER ASS'Y	1
M3	PQFF9909Z	FLYWHEEL ASS'Y	1
M3-1	PQFN35Z	WASHER-C	1
M4	PQFG9904Z	GEAR ASS'Y	1
M4-1	PQFN48Z	WASHER-D	1
M5	PQFR9912Z	TAKEUP REEL TABLE ASS'Y	1
M6	PQFR9913Z	SUPPLY REEL TABLE ASS'Y	1
M7	PQFD82Y	HEAD BASE PLATE	1
M8	PQFW42Z	HEAD BASE	1
M9	PQFS73Z	SPRING, RECORD/PLAYBACK HEAD	1
M10	PQJH1M2Z	RECORD/PLAYBACK HEAD	1
M11	PQJH6M2Z	ERASE HEAD	1
M12	PQFS109Z	SPRING, PINCH ROLLER	1
M13	PQFS110Z	SPRING, HEAD PLATE	1
M14	PQFJ2Z	TERMINAL	1
M15	PQFC9909X	CHASSIS ASS'Y	1
M16	PQFI14Z	RUBBER PARTS, MOTOR SPACER	2
M17	PQUP589Z	P.C. BOARD, REED SWITCH	1
M18	PQJS9B30Z	CONNECTOR, 9P	1
M19	PQFN33Z	WASHER (FOR OIL CUT)	2
M20	PQFB12Z	BELT	1
M21	PQFD64Z	PLATE SPRING	1
M22	PQFS82Z	SPRING, REEL TABLE	2
M23	PQFP126Y	PLUNGER	1
M24	PQHD15Z	SCREW	2
M25	PQFN49Z	WASHER (FOR LOCK OF FLYWHEEL)	1
M26	PQSE91Z	SWITCH, REED	1
M27	ERDS2TJ563	RESISTOR, 56 kΩ	1
		ACCESSORIES AND PACKING MATERIALS	
A1	PQJA59Y	CORD, TEL. S	1
A2	PQJA200Z	CORD, POWER ⚠	1
A3	PQJA30V	CORD, HANDSET	1
A4	RT-N30-JT1P	MICRO CASETTE TAPE	1
A5	PQHP416Z	RECORDING PAPER	1
A6	PQQX6246Z	INSTRUCTION BOOK	1
A7	PQQX9752Z	FAX CORRESPONDECE SHEET	1
A8	PQQX9636Z	CARD, DIAL	1
A9	PQQX9736Z	INSTRUCTION BOOK (QUICK REFERENCE) (ENGLISH)	1
A10	PQQX9737Z	INSTRUCTION BOOK (QUICK REFERENCE) (SPANISH)	1
A11	XZB25X34A04	PROTECTION COVER (DOCUMENT)	1
A12	XZB20X20A04	PROTECTION COVER (CORD)	1
A13	PQPH103Z	PROTECTION COVER (TRAY)	1
P1	PQPK1189Z	GIFT BOX	1
P2	PQPN1111Z	ACCESSORY BOX	1
P3	PQPN9056Z	CUSHION, COMPLETE	1
P4	PQPN935Z	HANDLE	1
P5	PQPH92Z	PROTECTION COVER (UNIT)	1

Ref. No.	Part No.	Part Name & Description	Pcs
		DIGITAL BOARD PARTS	
PCB1	PQWP1F50M	DIGITAL BOARD ASS'Y (NLA)	1
		(ICs)	
IC101	PQVIZ8400P6G	IC	1
IC102	PQWIF50M	IC	1
IC103	PQVIM5165FCL	IC S	1
IC104	PQVIR96MFX	IC	1
IC105	PQVIM5195BL	IC	1
IC106	PQVINJM4558M	IC	1
IC107	PQVISN7L06S	IC	1
IC201	PQVIDC0834CN	IC	1
IC301	PQVIE15R20F	IC	1
IC302	PQVISN7L374S	IC	1
IC303	PQVISN7H32S	IC	1
IC401	PQVINJM082BM	IC	1
IC402	PQVINJM082BM	IC	1
IC403	PQVINJM4558M	IC	1
IC404	PQVINJM082BM	IC	1
IC405	PQVITC4053BF	IC	1
IC406	PQVINJM2901M	IC	1
IC407	PQVITC4053BF	IC	1
IC501	PQVIE22R76F	IC	1
IC502	PQVIM5165FCL	IC S	1
QA201	PQVIBA12003	IC	1
QA202	PQVIBA12003	IC	1
		(TRANSISTORS)	
Q101	2SB1218A	TRANSISTOR(SI)	1
Q201	2SB1322	TRANSISTOR(SI)	1
Q202	2SB1322	TRANSISTOR(SI)	1
Q301-309	PQVTDTA114YU	TRANSISTOR(SI)	9
Q401	2SB1322	TRANSISTOR(SI)	1
Q402	2SC1740S	TRANSISTOR(SI)	1
Q403	2SD1819A	TRANSISTOR(SI)	1
Q404	2SA933	TRANSISTOR(SI)	1
		(DIODES)	
D103	1SS131	DIODE(SI)	1
D104	MA700A	DIODE(SI)	1
D201	1SS147	DIODE(SI)	1
D202	1SS147	DIODE(SI)	1
D301-306	1S1588	DIODE(SI)	6
D401-406	1SS131	DIODE(SI)	6
ZD101	MA4051	DIODE(SI)	1
ZD201	MA7200	DIODE(SI)	1
ZD202	MA7200	DIODE(SI)	1
ZD401	MA4039	DIODE(SI)	1
ZD402	PQVDHZS3A1	DIODE(SI)	1
		(COMPONENT COMBINATIONS)	
RA301	PQRSLD8X103J	RESISTOR ARRAY	1
LP101	EXEMT220B	NOISE FILTER	1
		(COIL)	
L101	PQLE53	CHOKE COIL S	1
		(CRYSTAL OSCILLATOR)	
X101	PQVCL2400N3Z	CRYSTAL OSCILLATOR	1
		(CAPACITORS)	
C101	ECEA0JKS101	100	1
C102	ECEA0JKS101	100	1
C103	ECEA1CK101	100 S	1

Ref. No.	Part No.	Value		Pcs
C104	PQCUV1H103KB	0.01		1
C105	PQCUV1H103KB	0.01		1
C106	PQCUV1E104MD	0.1		1
C107	PQCUV1E104MD	0.1		1
C108	PQCUV1E104MD	0.1		1
C109	PQCUV1C334ZF	0.33		1
C110	PQCUV1C334ZF	0.33		1
C111	PQCUV1E104MD	0.1		1
C112	ECEA1HKS010	1	S	1
C113	PQCUV1E104MD	0.1		1
C114	PQCUV1E104MD	0.1		1
C115	PQCUV1E104MD	0.1		1
C116	PQCUV1H103KB	0.01		1
C117	PQCUV1H103KB	0.01		1
C118	PQCUV1H220JC	22P		1
C119	PQCUV1H390JC	39P		1
C120	PQCUV1H220JC	22P		1
C121	PQCUV1H102J	0.001		1
C122	PQCUV1H102J	0.001		1
C123	PQCUV1E104MD	0.1		1
C124	ECEA1HKSR33	0.33	S	1
C125	PQCUV1H331JC	330P		1
C126	PQCUV1E104MD	0.1		1
C127	PQCUV1H560JC	56P		1
C201	ECEA1CKS100	10	S	1
C202	ECEA1CKS100	10	S	1
C203	PQCUV1E104MD	0.1		1
C204	PQCUV1E104MD	0.1		1
C205	PQCUV1H103KB	0.01		1
C206	PQCUV1E104MD	0.1		1
C207	PQCUV1H103KB	0.01		1
C208	PQCUV1E104MD	0.1		1
C209	PQCUV1H103KB	0.01		1
C210	Not Used			
C211	PQCUV1H103KB	0.01		1
C212	PQCUV1H103KB	0.01		1
C213	PQCUV1H103KB	0.01		1
C214	PQCUV1E104MD	0.1		1
C215	ECEA1VU221	220		1
C216	ECEA1CK101	100		1
C217	ECEA1CK101	100		1
C218	ECEA0JK221	220		1
C219	PQCUV1H153KB	0.015		1
C220	PQCUV1E104MD	0.1		1
C221	PQCUV1E104MD	0.1		1
C222	PQCUV1E104MD	0.1		1
C301-304	PQCUV1E104MD	0.1		4
C401	ECEA1CKS100	10	S	1
C402-410	PQCUV1E104MD	0.1		9
C411	PQCUV1H103KB	0.01		1
C412	ECQG1H681JZ	680P		1
C413	PQCUV1H103KB	0.01		1
C414	ECQG1H682JZ	0.0068		1
C415	PQCUV1E104MD	0.1		1
C416	PQCUV1H102J	0.001		1
C417-420	PQCUV1E104MD	0.1		4
C421	PQCUV1H391JC	390P		1
C501	ECEA1CKS100	10	S	1
C502-505	PQCUV1E104MD	0.1		4
		(RESISTORS)		
R101	PQ4R10XJ275	2.7M		1
R102	ERD25TJ271	270		1
R103	PQ4R10XF8662	86.6K		1
R104	ERDS2TJ563	56K		1
R105	PQ4R10XF8662	86.6K		1
R106	ERDS2TJ683	68K		1
R107	PQ4R10XJ272	2.7K		1
R108	ER016CKF1002	10K		1
R109	ER016CKF3652	36.5K		1
R110	PQ4R10XJ473	47K		1
R111	PQ4R10XJ103	10K		1
R112	PQ4R10XJ103	10K		1
R113	PQ4R10XJ473	47K		1

Part No.	Part No.	Value	Pcs
R114	PQ4R10XJ103	10K	1
R115	PQ4R10XJ333	33K	1
R116	PQ4R10XJ103	10K	1
R117	PQ4R10XJ103	10K	1
R118	Not Used		
R119	PQ4R10XJ472	4.7K	1
R120	PQ4R10XJ222	2.2K	1
R121	PQ4R10XJ3R3	3.3K	1
R122	PQ4R10XJ103	10K	1
R123	PQ4R10XJ101	100	1
R124	PQ4R10XJ103	10K	1
R125	Not Used		1
R126	Chip Jumper	0Ω	1
R127	PQ4R10XJ102	1K	1
R128	PQ4R10XJ100	10	1
R129	PQ4R10XJ102	1K	1
R130	PQ4R10XJ102	1K	1
R131	PQ4R10XJ101	100	1
R201	PQ4R10XJ103	10K	1
R202	ERDS1TJ222	2.2K	1
R203	PQ4R10XJ103	10K	1
R204	ERDS1TJ222	2.2K	1
R205	ERDS2TJ221	220	1
R206	ERDS2TJ221	220	1
R207	PQ4R10XJ3R3	3.3	1
R208	PQ4R10XJ100	10	1
R209	PQ4R10XJ473	47K	1
R210	PQ4R10XJ472	4.7K	1
R211	Not Used		
R212	Not Used		
R213	PQ4R10XJ103	10K	1
R214	Not Used		
R215	Not Used		
R216	ER016CKF2202	22K	1
R217	PQ4R10XJ473	47K	1
R218	ER016CKF1501	1.5K	1
R219	PQ4R10XJ473	47K	1
R220	PQ4R10XJ473	47K	1
R221	PQ4R10XJ472	4.7K	1
R222	Not Used		
R223-226	PQ4R10XJ472	4.7K	4
R227	Not Used		
R228	PQ4R10XJ103	10K	1
R229	PQ4R10XJ103	10K	1
R230	PQ4R10XJ103	10K	1
R231	PQ4R10XJ472	4.7K	1
R301-311	PQ4R10XJ331	330	11
R312-315	PQ4R10XJ103	10K	4
R316	PQ4R10XJ331	330	1
R317	PQ4R10XJ681	680	1
R318	PQ4R10XJ331	330	1
R319	PQ4R10XJ103	10K	1
R320	PQ4R10XJ103	10K	1
			1
R401	PQ4R10XJ103	10K	1
R402	PQ4R10XJ472	4.7K	1
R403	PQ4R10XJ103	10K	1
R404	PQ4R10XJ472	4.7K	1
R405	PQ4R10XJ103	10K	1
R406	PQ4R10XJ105	1M	1
R407	PQ4R10XJ222	2.2K	1
R408	PQ4R10XJ122	1.2K	1
R409	ER016CKF2002	20K	1
R410	ER016CKF1001	1K	1
R411	PQ4R10XJ472	4.7K	1
R412	PQ4R10XJ474	470K	1
R413	ER016CKF2202	22K	1
R414	ER016CKF1802	18K	1
R415	ER016CKF4701	4.7K	1
R416	PQ4R10XJ124	120K	1
R417	PQ4R10XJ103	10K	1
R418	PQ4R10XJ103	10K	1
R419	PQ4R10XJ102	1K	1
R420	ERDS1TJ222	2.2K	1
R421	PQ4R10XJ103	10K	1
R422	PQ4R10XJ681	680	1

Part No.	Part No.	Part Name & Description		Pcs
R423	PQ4R10XJ103	10K		1
R424	PQ4R10XJ103	10K		1
R425	PQ4R10XJ333	33K		1
R426	PQ4R10XJ563	56K		1
R427	PQ4R10XJ103	10K		1
R428	PQ4R10XJ823	82K		1
R429	PQ4R10XF1003	100K		1
R430	PQ4R10XJ102	1K		1
R431	PQ4R10XJ101	100		1
R432	PQ4R10XJ103	10K		1
R433	PQ4R10XJ103	10K		1
R434	PQ4R10XJ334	330K		1
R501	PQ4R10XJ103	10K		1
R502	PQ4R10XJ103	10K		1
		(BATTERY & CONNECTORS)		
BA101	BR2032/1HF1	LITHIUM BATTERY		1
CN101	PQJP8D94Z	CONNECTOR, 8P		1
CN102	PQJP4D94Z	CONNECTOR, 4P		1
CN103	PQJP2D107Z	CONNECTOR, 2P		1
CN104	PQJP4D94Z	CONNECTOR, 4P		1
CN105	PQJS30X59Z	CONNECTOR, 30P		1
CN106	PQJP9G74Z	CONNECTOR, 9P		1
CN107	PQJP3D94Z	CONNECTOR, 3P		1
CN108	PQJP6D94Z	CONNECTOR, 6P		1
CN109	PQJP7D94Z	CONNECTOR, 7P		1
CN110	PQJP16G72Z	CONNECTOR, 16P		1
CN111	PQJP17G72Z	CONNECTOR, 17P		1
CN112	PQJP11D70Z	CONNECTOR, 11P		1
		ANALOG BOARD PARTS		
PCB2	PQWP2F50M	ANALOG BOARD ASSY (NLA)		1
		(ICs)		
IC3	PQVIM3074AE1	IC		1
IC4	PQVINJM4558D	IC		1
IC5	PQVITMS3477	IC		1
IC6	PQVITM41256A	IC	S	1
IC7	PQVITM41256A	IC	S	1
IC8	PQVINJM4558D	IC		1
IC9	PQVIPD4066BC	IC	S	1
IC10	PQVINJ4053BD	IC		1
IC11	AN6181K	IC		1
IC12	PQVIBA6220	IC		1
IC13	PQVINJM4558D	IC		1
IC14	PQVINJM4558D	IC		1
IC15	PQVI672191F	IC		1
IC16	PQVINJM4558D	IC		1
		(TRANSISTORS)		
Q1	2SA1626	TRANSISTOR(SI)	⚠	1
Q2	2SD662B	TRANSISTOR(SI)	⚠	1
Q3	2SC2235	TRANSISTOR(SI)	⚠	1
Q4	PQVTBB1A4A	TRANSISTOR(SI)		1
Q5	Not Used			
Q6	PQVTDTC143E	TRANSISTOR(SI)		1
Q7	Not Used			
Q8	Not Used			
Q9	2SD1819A	TRANSISTOR(SI)	S	1
Q10	Not Used			
Q11	PQVTBB1A4A	TRANSISTOR(SI)		1
Q12	2SD1819A	TRANSISTOR(SI)	S	1
Q13	2SD1819A	TRANSISTOR(SI)	S	1
Q14	2SB1218A	TRANSISTOR(SI)	S	1
Q15	Not Used			
Q16	2SD1819A	TRANSISTOR(SI)	S	1
Q17	2SD1819A	TRANSISTOR(SI)	S	1
Q18	2SD1819A	TRANSISTOR(SI)	S	1
Q19	PQVTDTC143E	TRANSISTOR(SI)		1
Q20	2SD1994A	TRANSISTOR(SI)		1
Q21	2SB1322	TRANSISTOR(SI)		1
Q22	2SB1322	TRANSISTOR(SI)		1

Part No.	Part No.	Part Name & Description		Pcs
Q23	2SC1740S	TRANSISTOR(SI)		1
Q24	2SC1652	TRANSISTOR(SI)		1
Q25	2SC1652	TRANSISTOR(SI)		1
Q26	2SB1322	TRANSISTOR(SI)		1
Q27	2SB1322	TRANSISTOR(SI)		1
Q28	PQVTDTC143E	TRANSISTOR(SI)		1
Q29	2SD1994A	TRANSISTOR(SI)		1
Q30	PQVTDTC143E	TRANSISTOR(SI)		1
Q31	2SD2136	TRANSISTOR(SI)		1
Q39	PQVTDTC143E	TRANSISTOR(SI)		1
		(DIODES)		
D8	1S1588	DIODE(SI)		1
D9	Not Used			
D10	Not Used			
D11	PQVDHZS2B1	DIODE(SI)	⚠	1
D12-15	Not Used			
D16	MA4056	DIODE(SI)		1
D17	MA4056	DIODE(SI)		1
D18	MA4068	DIODE(SI)		1
D19-22	1SS131	DIODE(SI)		4
D23	1S1588	DIODE(SI)		1
D24-29	1SS131	DIODE(SI)		6
D30	PQVDS1YB40F1	DIODE(SI)	⚠	1
D31	Not Used			
D32-35	1SS131	DIODE(SI)		4
		(COILS)		
F1,2,3, L1-4	PQLE106	CHOKE COIL	⚠	7
L5,6	PQLQZK680K	CHOKE COIL	⚠	2
		(PHOTO ELECTRIC TRANSDUCERS)		
PC1	PQVIPC814K	PHOTO COUPLER	⚠	1
PC2,3	PQVIPC817CD	PHOTO COUPLER	⚠	2
		(RELAY)		
RLY1	PQSL61Z	RELAY	⚠	1
		(SWITCHES)		
S1	PQSS2A27Z	SWITCH, DIALING MODE		1
S2	ESE14A211	SWITCH, HOOK		1
S3	PQSS3B10Z	SWITCH, RINGER		1
		(TRANSFORMER)		
T1	ETA14Y85AY	CALL TRANSFORMER	⚠	1
		(VARIABLE RESISTORS)		
VR1	EVNDXAA03B23	SEMI-FIXED, 2KΩ (B)		1
VR3	EVNDXAA03B52	SEMI-FIXED, 500Ω (B)		1
VR4	Not Used			
VR5	PQVAL103A14A	VOLUME CONTROL, 10KΩ (A)		1
		(FILTERS)		
X1	PQVFCSB328D1	CERAMIC FILTER		1
X2	Not Used			
X3	PQVBA4.19M2	CERAMIC FILTER		1
		(VARISTOR)		
ZNR1	ERZC07DK820	VARISTOR	⚠	1
SA1	PQVDDDA401M	VARISTOR (SURGE ABSORBER)	⚠	1
SA2-5	PQVDSAE310F1	VARISTOR (SURGE ABSORBER)	⚠	4
		(CAPACITORS)		
C1	ECQE2E224JZ	0.22	⚠	1
C2-5	Not Used			
C6	ECKD2H681KB	680P	⚠	1
C7	ECKD2H681KB	680P	⚠	1
C8	ECKDKC222KB	0.0022	⚠ S	1

Part No.	Part No.	Value		Pcs
C9	Not Used			
C10	Not Used			
C11	Not Used			
C12	ECEA1HU100	10	⚠	1
C13	Not Used			
C14	Not Used			
C15	PQCUV1H121JC	120P		1
C16	PQCUV1C683MD	0.068		1
C17	Not Used			
C18	Not Used			
C19	PQCUV1E333MD	0.033		1
C20	PQCUV1H680JC	68P		1
C21	PQCUV1C683MD	0.068		1
C22	ECEA1HU220	22	⚠	1
C23	ECKD1H102JA	0.001		1
C24	PQCUV1H470JC	47P		1
C25-27	Not Used			
C28	PQCUV1H103KB	0.01		1
C29	PQCUV1E104MD	0.1		1
C30	PQCUV1E104MD	0.1	S	1
C31	ECEA1EU470	47	S	1
C32	PQCUV1H102J	0.001	⚠	1
C33-36	Not Used			
C37	ECEA1AU101	100	S	1
C38	ECEA1HU010	1		1
C39	Not Used			
C40	Not Used			
C41	PQCUV1E104MD	0.1		1
C42	ECEA1HU100	10	S	1
C43	ECEA1HUR22	0.22		1
C44	ECEA1HU100	10	S	1
C45	PQCUV1H153KB	0.015		1
C46	PQCUV1C683MD	0.068		1
C47	PQCUV1H103KB	0.01		1
C48	PQCUV1H103KB	0.01		1
C49	PQCUV1E104MD	0.1		1
C50	ECEA1HU010	1		1
C51	Not Used			
C52	PQCUV1H103KB	0.01		1
C53	PQCUV1H103KB	0.01		1
C54	PQCUV1H103KB	0.01		1
C55	ECEA1AU101	100	S	1
C56	PQCUV1H152KB	0.0015		1
C57	PQCUV1H472KB	0.0047		1
C58	PQCUV1E104MD	0.1		1
C59	Not Used			
C60	Not Used			
C61	PQCUV1H103KB	0.01		1
C62	PQCUV1E104MD	0.1		1
C63	PQCUV1E104MD	0.1		1
C64	PQCUV1H562KB	0.0056		1
C65	ECEA1AU221	220	S	1
C66	PQCUV1E104MD	0.1		1
C67	PQCUV1C683MD	0.068		1
C68	PQCUV1E333MD	0.033		1
C69	ECEA1HNR47S	0.47		1
C70	ECUV1H104MD	0.1	S	1
C71	ECEA1EU101	100	S	1
C72	ECEA1CU221	220		1
C73	ECUV1H104MD	0.1	S	1
C74	ECEA1CU221	220		1
C75	PQCUV1E104MD	0.1		1
C76	ECEA0JKS101	100		1
C77	PQCUV1E104MD	0.1		1
C78	Not Used			
C79	Not Used			
C80	PQCUV1H103KB	0.01		1
C81	PQCUV1H103KB	0.01		1
C82	ECEA1HU010	1		1
C83	Not Used			
C84	PQCUV1H103KB	0.01		1
C85	PQCUV1H103KB	0.01		1
C86	PQCUV1H681JC	680P		1
C87	PQCUV1C683MD	0.068		1
C88	ECEA0JU102	1000		1
C89	PQCUV1E104MD	0.1		1
C90	ECEA1AU221	220	S	1
C91	PQCUV1H103KB	0.01		1

Part No.	Part No.	Value		Pcs
C92	PQCUV1H391JC	390P		1
C93	ECEA1HU010	1		1
C94	PQCUV1E104MD	0.1		1
C95	Not Used			
C96	ECEA1HUR22	0.22		1
C97	PQCUV1H223KB	0.022		1
C98	PQCUV1C683MD	0.068		1
C99	Not Used			
C100	Not Used			
C101	PQCUV1E104MD	0.1		1
C102	ECUV1H104MD	0.1		1
C103	PQCUV1E104MD	0.1		1
C104	PQCUV1E104MD	0.1		1
C105	Not Used			
C106	PQCUV1H103KB	0.01		1
C107	ECEA1HU4R7	4.7		1
C108	PQCUV1H223KB	0.022	S	1
C109	ECEA1HU100	10	S	1
C110	ECEA1HU100	10	S	1
C111	ECEA0JU220	22		1
C112	ECEA1HU010	1		1
C113	PQCUV1H103KB	0.01		1
C114-116	Not Used			
C117	ECQG1H103JZ	0.01		1
C118	PQCUV1H471JC	470P		1
C119	PQCUV1C683MD	0.068		1
C120	PQCUV1H471JC	470P		1
C121	ECEA1AU101	100	S	1
C122	PQCUV1E104MD	0.1		1
C123	PQCUV1C683MD	0.068		1
C124	PQCUV1C683MD	0.068		1
C125	PQCUV1H331JC	330P		1
C126	PQCUV1H331JC	330P		1
C127	Not Used			
C128	ECEA1AU101	100	S	1
C129	PQCUV1C683MD	0.068		1
C130	ECEA1AU221	220	S	1
C131	PQCUV1H223KB	0.022		1
C132	Not Used			
C133	PQCUV1H103KB	0.01		1
C134	ECEA1AU101	100	S	1
C135	ECQP1H682GZ	0.0068		1
C136	ECQP1H682GZ	0.0068		1
C137	ECQP1H682GZ	0.0068		1
C138-143	Not Used			
C144	ECEA0JKS101	100		1
C145	PQCUV1E104MD	0.1		1
C146	PQCUV1H152KB	0.0015		1
C147-150	Not Used			
C151	ECEA1HU100	10		1
C152	PQCUV1C224ZF	0.22		1
C153	Not Used			
C154	Not Used			
C155	ECEA1AU101	100	S	1
C156	Not Used			
C157	ECQP1H682GZ	0.0068		1
C158	Not Used			
C159	PQCUV1E104MD	0.1		1
C160	Not Used			
C161	PQCUV1H103KB	0.01		1
C162-170	Not Used			
C185	ECEA1AU101	100	S	1
C300	ECEA1AU101	100	S	1
C301	ECEA1AU221	220	S	1
C302	PQCUV1E104MD	0.1		1
C303	PQCUV1E473MD	0.047		1
C304	PQCUV1H680JC	68P		1
C305	PQCUV1H103KB	0.01		1
C306	PQCUV1H103KB	0.01		1
C700	PQCUV1E333MD	0.033		1
C701	PQCUV1H103KB	0.01		1
		(RESISTORS)		
R1	ERD25TJ473	47K	⚠	1
R2-6	Not Used			
R7	PQ4R10XJ473	47K		1
R8	Not Used			

Part No.	Part No.	Value	Pcs
R9	PQ4R10XJ104	100K ⚠	1
R10	PQ4R10XJ472	4.7K ⚠	1
R11	PQ4R10XJ154	150K ⚠	1
R12	PQ4R10XJ564	560K ⚠	1
R13	ERDS2TJ102	1K	1
R14	PQ4R10XJ683	68K	1
R15	Not Used		
R16	ERDS2TJ103	10K ⚠	1
R17	ERDS2TJ472	4.7K ⚠	1
R18	Not Used		
R19	Not Used		
R20	PQ4R10XJ271	270	1
R21	PQ4R10XJ182	1.8K	1
R22	Not Used		
R23	PQ4R10XJ182	1.8K	1
R24	PQ4R10XJ473	47K	1
R25	PQ4R10XJ123	12K	1
R26	ER016CKF5360	536	1
R27	PQ4R10XJ472	4.7K	1
R28	PQ4R10XJ821	820	1
R29	PQ4R10XJ274	270K	1
R30	PQ4R10XJ222	2.2K	1
R31	PQ4R10XJ104	100K	1
R32	ER016CKF1541	1.54K	1
R33	PQ4R10XJ154	150K	1
R34	PQ4R10XJ104	100K	1
R35	PQ4R10XJ104	100K	1
R36	ER016CKF1541	1.54K	1
R37	ER016CKF6190	619	1
R38	PQ4R10XJ104	100K	1
R39	PQ4R10XJ224	220K	1
R40	PQ4R10XJ223	22K	1
R41	Not Used		
R42	PQ4R10XJ104	100K	1
R43	Not Used		
R44	PQ4R10XJ684	680K	1
R45-48			
R49	PQ4R10XJ473	47K	1
R50	Not Used		
R51	Not Used		
R52-54	Not Used		
R55	PQ4R10XJ472	4.7K	1
R56	Not Used		
R57	Not Used		
R58	Chip Jumper	0Ω	1
R59	Not Used		
R60	PQ4R10XJ101	100	1
R61	PQ4R18XJ100	10	1
R62	PQ4R10XJ103	10K	1
R63	PQ4R10XJ222	2.2K	1
R64	PQ4R10XJ182	1.8K	1
R65	PQ4R10XJ222	2.2K	1
R66	ERDS2TJ564	560K	1
R67	ERDS2TJ105	1M	1
R68	PQ4R10XJ682	6.8K	1
R69	PQ4R10XJ335	3.3M	1
R70	PQ4R10XJ154	150K	1
R71	PQ4R10XJ185	1.8M	1
R72	PQ4R10XJ394	390K	1
R73	PQ4R10XJ104	100K	1
R74	Not Used		
R75	Not Used		
R76	PQ4R10XJ335	3.3M	1
R77	PQ4R10XJ225	2.2m	1
R78	PQ4R10XJ475	4.7M	1
R79	PQ4R10XJ222	2.2K	1
R80	ERDS2TJ473	47K	1
R81	PQ4R10XJ683	68K	1
R82	PQ4R10XJ272	2.7K	1
R83	PQ4R10XJ473	47K	1
R84	PQ4R10XJ223	22k	1
R85	PQ4R18XJ223	22K	1
R86	PQ4R10XJ272	2.7K	1
R87	PQ4R10XJ153	15K	1
R88	PQ4R10XJ184	180K	1
R89	PQ4R10XJ393	39K	1
R90	PQ4R10XJ272	2.7K	1
R91	PQ4R10XJ222	2.2K	1

Part No.	Part No.	Value	Pcs
R92	PQ4R10XJ103	10K	1
R93	PQ4R10XJ103	10K	1
R94	ERDS2TJ391	390	1
R95	PQ4R10XJ103	10K	1
R96	PQ4R10XJ682	6.8K	1
R97	PQ4R10XJ473	47K	1
R98	PQ4R10XJ102	1K	1
R99	Not Used		
R100	PQ4R10XJ104	100K	1
R101	PQ4R10XJ223	22K	1
R102	PQ4R10XJ330	33	1
R103	Not Used		
R104	PQ4R10XJ124	120K	1
R105	PQ4R10XJ103	10K	1
R106	ERDS2TJ472	4.7K	1
R107	ERDS2TJ681	680	1
R108	ERD25TJ120	12	1
R109	PQ4R10XJ103	10K	1
R110	ERDS2TJ221	220	1
R111	PQ4R10XJ473	47K	1
R112	PQ4R10XJ473	47K	1
R113	PQ4R10XJ471	470	1
R114	PQ4R10XJ471	470	1
R115	PQ4R10XJ473	47K	1
R116	ERDS2TJ151	150	1
R117	PQ4R10XJ221	220	1
R118	ERDS2TJ102	1K	1
R119	ERDS2TJ103	10K	1
R120	Not Used		
R121	PQ4R10XJ122	1.2K	1
R122	PQ4R10XJ102	1K	1
R123	PQ4R10XJ394	390K	1
R124	PQ4R10XJ563	56K	1
R125	PQ4R10XJ181	180	1
R126	PQ4R10XJ183	18K	1
R127	PQ4R10XJ121	120	1
R128	PQ4R10XJ334	330K	1
R129	PQ4R10XJ222	2.2K	1
R130	PQ4R10XJ224	220K	1
R131	PQ4R10XJ104	100K	1
R132	PQ4R10XJ563	56K	1
R133	PQ4R10XJ563	56K	1
R134	PQ4R10XJ822	8.2K	1
R135	ERDS2TJ124	120K	1
R136	PQ4R10XJ682	6.8K	1
R137	PQ4R18XJ103	10K	1
R138	PQ4R10XJ2R2	2.2K	1
R139	PQ4R10XJ222	2.2K	1
R140	PQ4R10XJ103	10K	1
R141	PQ4R10XJ102	1K	1
R142	PQ4R10XJ103	10K	1
R143	ERDS2TJ103	10K	1
R144	PQ4R10XJ473	47K	1
R145	ERDS2TJ330	33	1
R146	PQ4R10XJ473	47K	1
R147	PQ4R10XJ333	33K	1
R148	Chip Jumper	0Ω	1
R149	PQ4R10XJ104	100K	1
R150	PQ4R10XJ223	22K	1
R151	PQ4R10XJ562	5.6K	1
R152	PQ4R10XJ152	1.5K	1
R153	PQ4R10XJ103	10K	1
R154	PQ4R18XJ103	10K	1
R155	PQ4R10XJ105	1M	1
R156	PQ4R10XJ681	680	1
R157	PQ4R10XJ224	220K	1
R158	PQ4R10XJ472	4.7K	1
R159	PQ4R10XJ105	1M	1
R160	PQ4R10XJ222	2.2K	1
R161	PQ4R10XJ152	1.5K	1
R162	PQ4R10XJ393	39K	1
R163	Not Used		
R164	ER016CKF21281	21.28K	1
R165	ER016CKF21281	21.28K	1
R166	ER016CKF10641	10.64K	1
R167	PQ4R10XJ474	470K	1
R168-171	Not Used		
R172	ERDS2TJ472	4.7K	1

Part No.	Part No.	Part Name & Description	Pcs
R173	PQ4R10XJ473	47K	1
R174	PQ4R10XJ103	10K	1
R175	PQ4R10XJ333	33K	1
R176	Not Used		
R177	PQ4R10XJ103	10K	1
R178	ERD25TJ5R6	5.6 ⚠	1
R179	Not Used		
R180	PQ4R10XJ472	4.7K	1
R181-187	Not Used		
R188	PQ4R10XJ223	22K	1
R189	PQ4R10XJ473	47K	1
R190-193	Not Used		
R194	PQ4R10XJ472	4.7K	1
R195	PQ4R10XJ105	1M	1
R196	Not Used		
R197	PQ4R10XJ472	4.7K	1
R198	Not Used		
R199	PQ4R10XJ470	47	1
R200	Not Used		
R201	PQ4R10XJ101	100	1
R202	PQ4R10XJ101	100	1
R203	PQ4R10XJ122	1.2K	1
R204	PQ4R10XJ684	680K	1
R205	PQ4R10XJ152	1.5K	1
R206-209	Not Used		
R210	PQ4R10XJ473	47K	1
R301	ERDS2TJ682	6.8K	1
R501	PQ4R10XJ473	47K	1
R502	PQ4R10XJ224	220K	1
J35	PQ4R18XJ472	4.7K	1
		(CONNECTORS & JACK)	
CN4	PQJS17B30Z	CONNECTOR, 17P	1
CN5	PQJS16B32Z	CONNECTOR, 16P	1
CN6	PQJP2G43Z	CONNECTOR, 2P	1
CN7	PQJP2G71Z	CONNECTOR, 2P	1
CN9	PQJP9D93Z	CONNECTOR, 9P	1
TEL JACK	PQJJ2TAA1Z	JACK, TELEPHONE ⚠	1
H/S JACK	PQJJ1TB18Z	JACK, HANDSET	1

OPERATION AND SENSOR BOARD PARTS

PCB3	PQWP3F50M	OPERATION & SENSOR BOARD ASS'Y (NLA)	1
		(DIODES)	
LED101	LN086WP38	LED	1
LED102	LN28RPXTA3	LED	1
LED103	LN28RPXTA3	LED	1
LED104-109	LN38GP	LED	6
LED110	PQVDGL1E11C	LED	1
LED111	LN28RPXTA3	LED	1
LED112	PQVDGL1D11E	LED	1
LED113	PQVDGL1E11C	LED	1
LED114	LN28RPXTA3	LED	1
		(RESISTORS)	
R101	ERD25TJ331	330	1
R701	ERDS2TJ331	330	1
R702	ERDS2TJ331	330	1
R801	ERDS2TJ331	330	1
R802	ERDS2TJ331	330	1
		(SWITCHES)	
S101	EVQ12405K	SWITCH, REW	1
S102	EVQ12405K	SWITCH, FF	1
S103	EVQ12405K	SWITCH, MEMO/2WAY	1
S104	EVQ12405K	SWITCH, PLAYBACK/PAUSE	1
S105	EVQ12405K	SWITCH, ICM ERASE	1
S106	EVQ12405K	SWITCH, PGM PLAY	1
S107	EVQ12405K	SWITCH, OGM REC	1
S108	PQSH1A33Z	SWITCH, 1	1
S109	PQSH1A33Z	SWITCH, 2	1
S110	PQSH1A33Z	SWITCH, 3	1
S111	PQSH1A33Z	SWITCH, 4	1
S112	PQSH1A33Z	SWITCH, 5	1
S113	PQSH1A33Z	SWITCH, 6	1
S114	PQSH1A33Z	SWITCH, 7	1
S115	PQSH1A33Z	SWITCH, 8	1
S116	PQSH1A33Z	SWITCH, 9	1
S117	PQSH1A33Z	SWITCH, 0	1
S118	PQSH1A33Z	SWITCH, *	1
S119	PQSH1A33Z	SWITCH, #	1
S120	EVQ12405K	SWITCH, FLASH	1
S121	EVQ12405K	SWITCH, REDIAL	1
S122	EVQ12405K	SWITCH, MONITOR/VOICE STDBY	1
S123	EVQ12405K	SWITCH, PROGRAM	1
S124	EVQ12405K	SWITCH, SET	1
S125	EVQ12405K	SWITCH, PAUSE	1
S126	EVQ12405K	SWITCH, AUTO	1
S127	EVQ12405K	SWITCH, RECEIVE MODE	1
S128	PQSH1A33Z	SWITCH, STOP/CLEAR	1
S129	PQSH1A33Z	SWITCH, START/COPY	1
S130	EVQ12405K	SWITCH, FINE (MODE)	1
S131	EVQ12405K	SWITCH, LIGHT ORIGINAL	1
S132	EVQ12405K	SWITCH, POLLING	1
S133	EVQ12405K	SWITCH, M1	1
S134	EVQ12405K	SWITCH, M2	1
S135	EVQ12405K	SWITCH, M3	1
S136	EVQ12405K	SWITCH, M4	1
S137	EVQ12405K	SWITCH, M5	1
S138	EVQ12405K	SWITCH, M6	1
S139	EVQ12405K	SWITCH, M7	1
S140	EVQ12405K	SWITCH, M8	1
S141	EVQ12405K	SWITCH, M9	1
S142	EVQ12405K	SWITCH, M10	1
SW901	ESE14A211	SWITCH, COVER OPEN	1
		(PHOTO ELECTRIC TRANSDUCERS)	
PC701	PQVIPS4506	SENSOR, DOCUMENT SET	1
PC702	PQVIPS4506	SENSOR, READ POSITION	1
PC801	PQVIPS6002	SENSOR, JAM	1
PC802	PQVIPS4506	SENSOR, RECODING PAPER	1
		(CONNECTORS)	
CN101	PQJS30X48Z	CONNECTOR, 30P	1
CN701	PQJS4R35Z	CONNECTOR, 4P	1
CN801	PQJS4R36Z	CONNECTOR, 4P	1
CN901	PQJS2R31Z	CONNECTOR, 2P	1

CCD BOARD PARTS

PCB4	PQWP4F50M	CCD BOARD ASS'Y (NLA)	1
		(ICs)	
IC101	PQVIM66705FP	IC	1
IC102	PQWP4F50M	CCD BOARD ASS'Y (NLA)	1
		(TRANSISTORS)	
Q101	2SD1819A	TRANSISTOR(SI) S	1
Q102	2SD1819A	TRANSISTOR(SI) S	1
		(VARIABLE RESISTOR)	
VR101	EVNDXAA03B23	SEMI-FIXED, 2K(B)	1
		(CAPACITORS)	
C101	PQCUV1H103KB	0.01	1
C102	ECEA1CKS100	10	1
C103	ECEA1CKS100	10	1
C104-108	PQCUV1E104MD	0.1	5

Part No.	Part No.	Part Name & Description		Pcs
		(RESISTORS)		
R101	PQ4R10XJ101	100		1
R102	PQ4R10XJ100	10		1
R103	PQ4R10XJ101	100		1
R104	PQ4R10XJ100	10		1
R105	PQ4R10XJ331	330		1
R106	PQ4R10XJ101	100		1
R107	PQ4R10XJ470	47		1
R108	PQ4R10XJ104	100K		1
R109	PQ4R10XJ472	4.7K		1
R110	PQ4R10XJ221	220		1
R111	PQ4R10XJ223	22K		1
R112	PQ4R10XJ102	1K		1
R113	PQ4R10XJ102	1K		1
		(CONNECTOR)		
CN101	PQJS8R32Z	CONNECTOR, 8P		
		SWITCHING POWER SUPPLY BOARD PARTS		
PCB5	PQLP017Z	SWITCHING POWER SUPPLY BOARD ASS'Y (NLA)	⚠	1
		(ICs)		
IC401	PQVIUPC1093J	IC	S	1
IC402	PQVINJ2360D	IC		1
IC403	PQVITA7812AP	IC		1
IC404	PQVITA7812AP	IC		1
IC451	PQVIM51977P	IC	⚠	1
		(TRANSISTORS)		
Q403	2SD1266P	TRANSISTOR(SI)	S	1
Q404	PQVTDTC143XS	TRANSISTOR(SI)		1
Q405	2SK1488	TRANSISTOR(SI)	⚠ S	1
		(DIODES)		
D401	PQVDD5SBA40S	DIODE(SI)	⚠	1
D402-406	Not Used			
D407	PQVDD10LC20U	DIODE(SI)		1
D408	PQVDD5LC20U	DIODE(SI)		1
D409	PQVD1GU42	DIODE(SI)	S	1
D410	MA4270	DIODE(SI)		1
D411	Not Used			
D412	Not Used			
D413	1SS147	DIODE(SI)		1
D414	PQVDD5LC20U	DIODE(SI)		1
D415	MA7062	DIODE(SI)		1
D451	Not Used			
D452	PQVD1GU42	DIODE(SI)	⚠	1
D453	PQVD1JU41	DIODE(SI)	⚠	1
D454	Not Used			
D455	PQVD1GU42	DIODE(SI)	⚠	1
		(FUSE)		
F401	XBA1C50NU100	FUSE	⚠	1
F402	Not Used			
F403	PQBA1P15NMAL	FUSE	⚠	1
		(COILS)		
L401	PQLE105	COIL, CHOKE	⚠	1
L402	PQLE104	COIL, CHOKE	⚠	1
L403	PQLE107	COIL, CHOKE		1
		(PHOTO ELECTRIC TRANSDUCERS)		
PC401	PQVIPC817K	PHOTO COUPLER	⚠	1
PC402	PQVIPC817K	PHOTO COUPLER	⚠	1

Part No.	Part No.	Part Name & Description		Pcs
		(THERMISTORS)		
TH401	PQRTD5FFL8R0	THERMISTOR	⚠	1
TH402	PQRTE0FFF103	THERMISTOR		1
		(TRANSFORMER)		
T401	ETS33K336V	SWITCHING TRANSFORMER		1
		(RELAY)		
RLY401	PQSL79Z	RELAY		1
		(CAPACITORS)		
C401	ECQU1A104MH	0.1	⚠	1
C402	ECKZRS222ME	0.0022	⚠	1
C403	ECKZRS222ME	0.0022	⚠	1
C404	ECQU1A104MH	0.1	⚠	1
C405	PQVDSR471KD	VARISTOR	⚠	1
C406	PQVDSR471KD	VARISTOR	⚠	1
C407	ECKDRS332ME	0.0033	⚠	1
C408	ECKDRS332ME	0.0033	⚠	1
C409-415	Not Used			
C416	EC0S1VG392L	3900		1
C417	ECEA1HGE100	10		1
C418	ECEA1VGE222	2200		1
C419	Not Used			
C420	ECEA1VGE471	470		1
C421	Not Used			
C422	Not Used			
C423	ECEA1VGE101	100		1
C424	ECEA1EGE470	47		1
C425-429	Not Used			
C430	ECEA1EGE101	100		1
C431-433	Not Used			
C434	ECEA1AGE332	3300		1
C435	ECCD1H151JC	150P		1
C436	ECEA1VGE102	1000		1
C437-439	Not Used			
C440	ECKZRS102ME	0.001		1
C441	ECQV1H104JZ	0.1		1
C442	ECQV1H104JZ	0.1		1
C443	ECQV1H104JZ	0.1		1
C444	Not Used			
C451	EC0S2DG561M	560	⚠	1
C452-454	Not Used			
C455	ECQB1H391KF	390P	⚠	1
C456	ECEA1VGE220	22	⚠	1
C457	ECQV1H104JZ	0.1	⚠	1
C458	ECKD3A221KBN	220P	⚠	1
C459	ECQE6473B	0.047	⚠	1
C460	ECQV1H104JZ	0.1	⚠	1
C461	Not Used			
C462	ECEA1VGE101	100	⚠	1
C463	ECQV1H154JZ	0.15	⚠	1
C464	ECQM1H103JV	0.01	⚠	1
C465	Not Used			
C466	Not Used			
C467	ECQV1H104JZ	0.1	⚠	1
		(RESISTORS)		
R411	ERG2SJ221	220		1
R412	ER016CKF1002	10K		1
R413	ER016CKF1131	1.13K		1
R414	Not Used			
R415	ERG1SJ561	560		1
R431	ERX1SJR22	0.22		1
R432	ER016CKF3651	3.65K		1
R433	ER016CKF1201			1
R434	ERDS1TJ121	120		1
R435	ERDS1TJ154	150K	⚠	1
R436	ERDS1TJ154	150K	⚠	1
R437	Chip Jumper	0Ω		1
R438	Not Used			
R439	Not Used			
R440	ERX3SJ5R6	5.6		1
R441	ERG2SJ122	1.2K		1

Part No.	Part No.	Part Name & Description	Pcs
R452	ERDS2TJ270	27 ⚠	1
R453	Not Used		
R454	ERG3SJ104	100K ⚠	1
R455	Not Used		
R456	ER016CKF1472	14.7K ⚠	1
R457	ER016CKF2212	22.1K ⚠	1
R458	ERG3SJ470	47 ⚠	1
R459	ERX3SJR10	0.1 ⚠	1
R460	ERDS2TJ331	330 ⚠	1
R461	ERDS2TJ331	330 ⚠	1
R462	ERG2SJ683	68K ⚠	1
R463	ERG3SJ470	47 ⚠	1
R464	ERDS2TJ103	10K ⚠	1
R465	ERDS2TJ103	10K ⚠	1
R466	ERDS1TJ181	180 ⚠	1
R467	ERDS2TJ391	390 ⚠	1
R468	ERDS2TJ123	12K ⚠	1
R469	ERG2SJ683	68K ⚠	1
R480	ERDS2TJ273	27K ⚠	1
		(CONNECTORS)	
CN401	PQJP3D97Z	CONNECTOR, 3P ⚠	1
CN402	PQJP11D70Z	CONNECTOR, 11P	1
CN403	Not Used		
CN404	PQJP10G74Z	CONNECTOR, 10P	1

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